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TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

EIGHTH SESSION,

HELD AT WASHINGTON, D. C.,

MAY 29, 30, AND 31, 1894.

VOLUME VII.

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LIST OF OFFICERS.

[Elected May 30, 1894.]

PRESIDENT.

JOHN RIDLON, M.D.,

VICE-PRESIDENTS.

BERNARD BARTOW, M.D.
LOUIS A. WEIGEL, M.D.

TREASURER.

E. G. BRACKETT, M.D.

SECRETARY.

ROYAL WHITMAN, M.D.,
126 West 59th Street, New York.

COMMITTEE ON MEMBERSHIP.

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ANSEL G. COOK, M.D. JOHN C. SCHAPPS, M.D.
GEORGE W. RYAN, M.D.

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H. AUGUSTUS WILSON, M.D.

MEMBER OF EXECUTIVE COMMITTEE, CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS.

A. M. PHELPS, M.D.
Alternate: E. H. BRADFORD, M.D.

LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.
1892. BENJAMIN LEE, M.D.
1893. A. J. STEELE, M.D.
1894. A. M. PHELPS, M.D.
1895. JOHN RIDLON, M.D.

MEMBERS.

* Original Members.
† Deceased.

1889. Bartow, Bernard, M.D. Clinical Professor of Orthopedic Surgery in the Medical Department of the University of Buffalo. *Vice-President*, 1895. 220 Franklin Street, Buffalo, N. Y.

1892. Blanchard, Wallace, M.D. Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 34 E. Monroe Street, Chicago.

1889. Brackett, E. G., M.D. Assistant Surgeon to the Children's Hospital. *Treasurer*, 1895. 133 Newbury Street, Boston.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Children's and the Good Samaritan Hospitals; Assistant Professor of Orthopedic Surgery in Harvard Medical School. 133 Newbury Street, Boston.

*†1887. Brown, Buckminster, M.D.

*1887. Brown, Dillon, M.D. Adjunct Professor of Diseases of Children in the New York Polyclinic; Consulting Physician (in Pediatrics) to the Astoria Hospital; Visiting Physician to the Episcopal Orphans' Asylum and the St. John's Guild Hospital for Children. 40 East Fifty-seventh Street, New York.

*1887. Bryant, Joseph D., M.D. Professor of Anatomy and of Clinical Surgery, and Associate Professor of Orthopedic Surgery in Bellevue Hospital Medical College; Visiting Surgeon to Bellevue and St. Vincent Hospitals; Surgeon-General National Guard, S. Y. N. 54 West Thirty-sixth Street, New York.

1889. Burrell, Herbert L., M.D. Surgeon to the Boston City and Children's Hospitals; Demonstrator of Surgical Appliances, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. Orthopedic Surgeon to the Hartford Hospital. 164 High Street, Hartford, Conn.

1893. Coolidge, Frederic S., M.D. Lecturer on Orthopedic Surgery in Rush Medical College; Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 103 State Street, Chicago.

*†1887. Develin, Edward, M.D.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital; Visiting Physician to the Avon Home for Children; Visiting Physician to St. Luke's Home for Children. 5 Riedesel Avenue, Cambridge, Mass.

*1887. Gibney, V. P., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Surgeon-in-chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Child's Hospital, New York. 16 Park Ave., New York.

1889. Gillette, Arthur J., M.D. Visiting Orthopedic Surgeon to University Dispensary; and Orthopedic Surgeon to St. Luke's Hospital, St. Paul. 301 Pleasant Avenue, St. Paul, Minnesota.

1892. Goldthwait, Joel E., M.D. Surgeon to the Good Samaritan Hospital; Assistant Surgeon to the Children's Hospital; Surgeon to Out-patients, and Chief of Orthopedic Clinic at the Carney Hospital. 398 Marlborough Street, Boston.

1894. Goodwin, Frederick A., M.D. Assistant in the Orthopedic Clinic of the Post-Graduate Hospital. 62 West Thirty-fifth Street, New York.

1892. Griffith, J. D., M.D. Professor of Surgery, Kansas City Medical College; Surgeon to All Saints, St. Joseph's, Children's, and German Hospitals; President of the State Board of Health; Surgeon-General National Guard S. Mo. S. W. corner Ninth and Grand Avenue, Kansas City, Missouri.

1892. Hoadley, A. E., M.D. Professor of Orthopedic Surgery and Surgical Diseases of Joints, Chicago Polyclinic; Pro-

fessor of Orthopedic Surgery and Surgical Diseases of Joints and Clinical Surgery, College of Physicians and Surgeons; Attending Orthopedic Surgeon to the Home for Destitute Crippled Children, Chicago. 683 Washington Boulevard, Chicago.

*1887. HODGEN, HARRY, M.D. 2604 Locust Street, St. Louis.

1893. HOSMER, A. B., M.D. Orthopedic Surgeon to St. Luke's Hospital; Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 103 State Street, Chicago, Ill.

1893. HUBBARD, LEROY, W., M.D. Senior Assistant Surgeon, New York Orthopedic Hospital and Dispensary. 161 West Twenty-third Street, New York.

*1887. JUDSON, A. B., M.D. Orthopedic Surgeon to the Outpatient Department of the New York Hospital. 38 East Twenty-fifth Street, New York.

1894. KERR, JAMES, M.D., M.Ch. Surgeon to the Emergency Hospital; Surgeon to the Providence Hospital; Surgeon to the Woman's Hospital; Professor of Surgery in the Georgetown University. 1711 H Street, N. W., Washington, D. C.

*1887. KETCH, SAMUEL, M.D. Senior Assistant Surgeon to the New York Orthopedic Hospital; Surgeon to the Randall's Island Hospital; Clinical Professor of Orthopedic Surgery in the New York Woman's Medical College. 328 West Twenty-ninth Street, New York.

*1887. LEE, BENJAMIN, M.D. Secretary of the State Board of Health of Pennsylvania; Professor of Orthopedics in the Philadelphia Polyclinic and College for Graduates in Medicine. 1532 Pine Street, Philadelphia.

*1887. LOVETT, ROBERT W., M.D. Surgeon to the West End Nursery; Assistant Surgeon to the Children's Hospital; Outpatient Surgeon to the Boston City Hospital. 379 Boylston Street, Boston.

1893. MCCURDY, STEWART LEROY, M.D. Professor of Orthopedic and Clinical Surgery, Ohio Medical University, Columbus, Ohio; Lecturer on Topographical Anatomy and Landmarks, Western Pennsylvania Medical College, Pittsburg, Pa.;

Surgeon to the Protestant Hospital, Columbus, Ohio. Dennison, Ohio.

1889. McKenzie, B. E., M.D. Lecturer on Orthopedic Surgery in the Woman's Medical College; Consulting Orthopedic Surgeon to the Hospital for Sick Children, Toronto. 14 Bloor Street, West Toronto, Canada.

*1887. Moore, James E., M.D. Professor of Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children. 125 Fourth Street, South, Minneapolis, Minn.

1889. Myers, T. Halsted, M.D. Orthopedic Surgeon to St. Luke's Hospital; Assistant Surgeon to the New York Orthopedic Dispensary; Surgeon to the Presbyterian Hospital Dispensary. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the University of Colorado. 1405 Stout Street, Denver.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1890. Phelps, A. M., M.D. Professor of Surgery in the University of Vermont; Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the City Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt.; Surgeon-in-chief to the Orthopedic Department of the Post-Graduate Hospital, New York. 40 West Thirty-fourth Street, New York.

1893. Plympton, W. O., M.D. Instructor in Orthopedic Surgery, Post-Graduate Medical School and Hospital; Assistant to the Chair of Orthopedic Surgery, University Medical School; Visiting Surgeon to the Post-Graduate Hospital, New York. 40 West Thirty-fourth Street, New York.

*1887. Ridlon, John, M.D. Professor of Orthopedic Surgery in the Northwestern University Medical School; Professor of Orthopedic Surgery in the Post-Graduate Medical School of Chicago; Senior Attending Orthopedic Surgeon to St. Luke's Hospital; Medical Director of the Home for Destitute Crippled Children. *President*, 1895. 103 State Street, Chicago.

*1887. Ryan, George W., M.D. Clinical Lecturer on Orthopedic Surgery in the Medical College of Ohio. 114 West Ninth Street, Cincinnati.

1889. Sayre, Lewis A., M.D. Professor of Orthopedic Surgery in the Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue Hospital, the Charity Hospital, and the Home for Incurables. 285 Fifth Avenue, New York.

*†1887. Sayre, Lewis Hall, M.D.

*1887. Sayre, Reginald H., M.D. Assistant to the Chair of Surgery in Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of Bellevue Hospital. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Orthopedic Surgeon to St. Mary's Hospital Dispensary, Brooklyn. 498 Bedford Avenue, Brooklyn.

1889. Scudder, Charles Locke, M.D. Assistant in Surgery in Harvard University; Surgeon to the Out-patient Department of Massachusetts General Hospital. 1 Marlborough Street, Boston.

*1887. Shaffer, Newton M., M.D. Attending Surgeon-in-charge of the New York Orthopedic Hospital and Dispensary; Consulting Orthopedic Surgeon to St. Luke's Hospital; Consulting Surgeon to the New York Infirmary for Women and Children. 28 East Thirty-eighth Street, New York.

1889. Sherman, Harry M., M.D. Orthopedic Surgeon to the Children's Hospital, and to the Polyclinic, San Francisco. 705 Sutter Street, San Francisco.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery and Diseases of the Joints in the St. Louis Post-Graduate School of Medicine; Surgeon to the Augusta Children's Hospital, St. Louis. 2825 Washington Avenue, St. Louis.

*1887. TAYLOR, HENRY LING, M.D. 201 West Fifty-fourth Street, New York.

1892. TAYLOR, WILLIAM J., M.D. Surgeon to St. Agnes's Hospital; Assistant Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases. 116 South Eighteenth Street, Philadelphia.

1892. THORNDIKE AUGUSTUS, M.D. Surgeon to the Good Samaritan Hospital and to the Boston Dispensary. 101 Beacon Street, Boston.

1889. TOWNSEND, W. R., M.D. Lecturer on Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Orthopedic Surgeon to the French Hospital. 28 West Fifty-ninth Street, New York.

*1887. VANCE, AP MORGAN, M.D. Surgeon to the Louisville City Hospital, to Sts. Mary and Elizabeth Hospital, and to the Masonic Widows' and Orphans' Home and Infirmary. 229 West Chestnut Street, Louisville, Ky.

1889. WEIGEL, LOUIS A., M.D. Orthopedic Surgeon to the Out-patient Department of Rochester City Hospital. *Vice-President*, 1895. 43 Mortimer Street, Rochester, N. Y.

1890. WHITMAN, ROYAL, M.D. Clinical Instructor in Orthopedic Surgery and Chief of the Orthopedic Division of the Vanderbilt Clinic in the College of Physicians and Surgeons; Lecturer on Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Out-patients in the Hospital for Ruptured and Crippled, New York. *Secretary*, 1895. 126 West Fifty-ninth Street, New York.

*1887. WILLARD, DE FOREST, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. 1601 Walnut Street, Philadelphia.

1891. WILSON, H. AUGUSTUS, M.D. Clinical Professor of

Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Orthopedic Surgeon in the Polyclinic Hospital; Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Surgeon to St. Mark's Home for Aged and Infirm Women, Philadelphia; Consulting Orthopedic Surgeon to the Kensington Hospital for Women, and to the Philadelphia Lying-in Charity. 1611 Spruce Street, Philadelphia.

1893. Wirt, William E., M.D. Professor of Orthopedic Surgery in the Medical Department University of Wooster, Cleveland, Ohio; Visiting Surgeon to University Hospital; Orthopedic Surgeon to Cleveland Hospital for Women and Children. 122 Euclid Avenue, Cleveland, Ohio.

1890. Young, James K., M.D. Instructor in Orthopedic Surgery in the University of Pennsylvania; Attending Surgeon to the Orthopedic Department of the University Hospital. 222 South Sixteenth Street, Philadelphia.

HONORARY MEMBERS.

ELECTED

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1889. HENRY G. DAVIS, M.D., 8 Parlin Street, Everett, Mass.

1892. WILLIAM DETMOLD, M.D., 38 East Ninth Street, New York.

1893. O. LANNELONGUE. Professeur à la Faculté de Médecine de Paris (Chaire de Chirurgie); Membre de l'Académie de Médecine; Chirurgien de l'Hôpital Trousseau à Paris, et Député au Parlement Français, et Président de l'Association Générale de Médecine de France. 3 Rue François I., Paris.

*1889. W. J. LITTLE, M.D., F.R.C.P. Lond., M.R.C.S. Eng.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery, and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1893. LEOPOLD OLLIER. Professeur du Clinique Chirurgicale à la Faculté de Médecine de Lyon; Correspondant de l'Institut de France. 3 Quai de la Charité, Lyons.

*1889. DAVID PRINCE, M.D.

1891. C. FAYETTE TAYLOR, M.D., 201 West Fifty-fourth Street, New York.

* Deceased.

CORRESPONDING MEMBERS.

ELECTED

1890. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 5 Henrietta Street, Cavendish Square, W., London, England.

1889. Dr. F. BEELY, Steglitzer Strasse 10, Berlin, Germany.

1892. Dr. M. BILHAUT (Rédacteur en Chef des Annales d'Orthopédie et de Chirurgie pratiques; Chirurgien des enfants de l'Hôpital International. 5 Avenue de l'Opéra, Paris, France.

1894. BERNARD E. BRODHURST, F.R.C.S. Eng. Senior Surgeon to the Royal Orthopedic Hospital; Surgeon to the Royal Hospital for Incurables; Consulting Surgeon to the Belgrave Children's Hospital. 20 Grosvenor Street, Grosvenor Square, London, W.

1893. Dr. JULIUS DOLLINGER, ausserordentlich-öffentlicher Professor für Orthopädie an den königl. ungarischen Universität in Buda-Pest, Operateur und dirigirenden Oberarzt der chir. Abtheilung im Spitalls der Barmherzigen Brüder in Buda-Pest; Mitglied des Landessanitätsrathes; Mitglied des Landesunterrichtsrathes; Mitglied mehrer wissenschaftlichen Gesellschaften und Vereine. Buda-Pest (Ungarn), Rerepescher Str. 52.

1892. NICHOLAS GRATTAN, F.R.C.S. Edin., Senior Surgeon County and City of Cork Hospital for Women and Children, 24 South Mall, Cork, Ireland.

1890. Dr. A. HOFFA, Privatdocent der Chirurgie an der Universität Würzburg. Sieboldstrasse 10, Würzburg.

ELECTED

1890 ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital. 11 Nelson Street, Great George Square, Liverpool, England.

1890. Dr. E. KIRMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants Assisté. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIGFRED LEVY, Superintending Surgeon of the Society for the Relief of Crippled and Mutilated Children, Copenhagen. 135 Gothersgade, Copenhagen, Denmark.

1892. ERNEST MUIRHEAD LITTLE, F.R.C.S. Eng., Surgeon to the National Orthopedic Hospital. 40 Seymour Street, Portman Square, London, England.

1889. Prof. Dr. ADOLF LORENZ. IX. Garnisongasse 3 (Garellihof), Vienna, Austria.

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F R.C.S., Surgeon to and Joint Lecturer on Surgery at St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istituto dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL REDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

ELECTED

1888. BERNARD ROTH, F.R.C.S. Eng. 29 Queen Anne Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., D.M.; Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. 24 Queen Anne Street, Cavendish Square, W., London, England.

*1890. HUGH OWEN THOMAS, M.R.C.S. Eng.

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen; Assistant Surgeon and Surgeon in Charge of Orthopedic Department, and Lecturer on Anatomy, St. Bartholomew's Hospital; Surgeon, Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Burnley Cottage Hospital. 77 Harley Street, London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon., F.R.C.S.; Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

* Deceased.

MINUTES

OF THE

EIGHTH ANNUAL MEETING

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

Held at Washington, D. C., on May 29, 30, and 31, 1894.

First Day—*Morning Session.*

The Association met in the Preparatory Department of the Columbian University, and was called to order by the President, Dr. A. M. Phelps, at 9 o'clock.

A paper entitled "Observations on Bending of the Neck of the Femur in Adolescence," was read by Dr. Royal Whitman.

A paper entitled "Blanchard's Hip Splint," was read by Dr. Wallace Blanchard.

A paper entitled "The Question of Priority in the Application of Lateral Traction to Relieve Intra-articular Pressure in Hip Disease," was read by Dr. A. M. Phelps.

The three papers were discussed by Drs. Weigel, Gillette, Coolidge, Phelps, Blanchard, and Whitman.

A paper entitled "Congenital Dislocation of the Hip," was read by Dr. L. A. Weigel.

Discussed by Drs. Lee, Coolidge, and Weigel.

A paper entitled "The Etiology of Deformities in Knee-joint Disease," was read by Dr. A. E. Hoadley.

Discussed by Drs. Wirt, Whitman, Phelps, Ridlon, and Hoadley.

The Association then went into

Executive Session.

The Committee on Membership reported for election for Corresponding Membership—M. Bernard Brodhurst, of London; for Active

Membership—Dr. Frederick A. Goodwin, of New York, and Dr. James Kerr, of Washington.

These gentlemen were unanimously elected to membership as above indicated.

On motion of Dr. Lee, it was voted to suspend the By-laws and to hold the second executive session at noon on the 30th inst.

On motion of Dr. Weigel, it was voted to suspend the By-laws and permit the Committee of Membership to report on one other candidate at the second executive session.

The following candidates were nominated for Active Membership:

Dr. John Dane, of Boston, by Drs. Bradford and Ridlon. Dr. Samuel E. Milliken, of New York, by Drs. Ridlon and Phelps.

On motion of Dr. Weigel, it was voted to donate one full set of TRANSACTIONS of the Association to the University of Melbourne, Australia.

On motion of Dr. Bradford, it was voted to remit the dues of the Corresponding Members for the coming year, and to return to Corresponding Members all dues heretofore collected from them.

Drs. Bradford and Ryan submitted the following amendment to the Constitution:

"Corresponding Members shall pay annual dues of five dollars," comprising the last sentence of Article VIII. of the Constitution, shall be expunged.

A summary of the Treasurer's report was read by the Secretary.

On motion of Dr. Coolidge, it was voted to accept the report.

Drs. Whitman and Bradford were appointed Auditing Committee.

The executive session then adjourned and the scientific work was resumed.

A paper entitled "Cases of Hoffa's Operation for Congenital Dislocation of the Hip-joint,' was read by Dr. Bradford.

Discussed by Drs Whitman, Ryan, Weigel, Willard, Bartow, Wirt, Phelps, and Bradford.

The session then adjourned.

SECOND DAY—*Morning Session.*

The meeting was called to order by the President at 9 o'clock.

Dr. C. G. Page, of Boston, by invitation, read a paper entitled "Lateral Traction in Hip Disease."

Discussed by Drs. Phelps and Page.

Dr. V. P. Gibney read a paper entitled "The Correction of the

Deformity of Hip Disease; Its Value During the Progress of the Disease; Its Importance on the Subsidence of the Disease; One Hundred Cases Analyzed."

Discussed by Drs. Wirt, Ketch, Whitman, Cook, Gillette, and Gibney.

Dr. Herman Mynter, of Buffalo, by invitation, read a paper entitled "Excision of the Wrist-joint by a New Method."

Discussed by Drs. Whitman, Bradford, and Mynter.

A paper entitled "Lorenz Osteoclast," was read by Dr. F. Coolidge.

Discussed by Drs. Gibney, Myers, Ketch, Bartow, Phelps, and Coolidge.

"Discussion on Flat-foot," opened by Dr. Royal Whitman, in the absence of Dr. N. M. Shaffer; continued by Dr. L. A. Weigel, who exhibited foot-plates of phosphor bronze.

Dr. A. G. Cook showed a modification of the conventional spring.

"Discussion on Rhachitic Deformities," opened by Dr. A. Jacobi, of New York, with a paper entitled "Etiology: Clinical History and Lesions;" followed by Dr. Benjamin Lee with a paper entitled "Its Various Manifestations, Diagnosis, Differential Diagnosis, and Prognosis;" followed by Dr. Samuel Ketch with a paper entitled "Mechanical Treatment."

The session then adjourned.

Executive Session.

The minutes of the first executive session were read and approved.

The Auditing Committee reported, approving the accounts of the Treasurer. The Treasurer's accounts were accepted and the committee was discharged.

Dr. F. S. Coolidge, Secretary of the Chicago Orthopedic Society, extended an invitation from the Chicago Society to the Association to hold the next meeting of the Association in Chicago.

On motion of Dr. Willard, it was voted to tender the thanks of the Association to the Chicago Orthopedic Society.

Dr. Weigel moved that the invitation be accepted. This was amended, and the amendment was accepted, to postpone action until after the election of President of the Association.

The following officers were then elected:

President—Dr. John Ridlon.

First Vice-President—Dr. Bernard Bartow.

Second Vice-President—Dr. L. A. Weigel.

Secretary—Dr. Royal Whitman.

Treasurer—Dr. E. G. Brackett.

Member of the Committee of Arrangements of the Congress of American Physicians and Surgeons—Dr. James Kerr.

Member of the Executive Committee of the Congress of American Physicians and Surgeons—Dr. A. M. Phelps.

Alternate—Dr. E. H. Bradford.

It was then voted to hold the next meeting of the Association at Chicago.

Dr. Ryan moved that the Member of the Executive Committee of the Congress be instructed to vote for a change of the place of meeting of the next Congress.

Dr. Whitman moved as an amendment that this question be left to the discretion of the member. The motion as amended was carried.

On motion of Dr. Ridlon, it was voted that it is the sense of the Association that the Congress continue to meet at Washington.

The meeting then adjourned.

Third Day—*Morning Session.*

In the absence of the President, the meeting was called to order by the Secretary.

In the absence of the Vice-Presidents, Dr. Benjamin Lee was elected chairman *pro tem.*

Dr. Willard continued the discussion on "Rhachitic Deformities" by a paper entitled "Operative Treatment." The general discussion was continued by Drs. Weigel, Ryan, Gillette, Cook, Bartow, Townsend, Coolidge, Ketch, Lee, and Willard.

Dr. John C. Schapps read a paper entitled "Relief of the Spondylitic Spine from Concussion of Walking."

Discussed by Drs. Foster, Ketch, Ryan, and Schapps.

Dr. Bernard Bartow read a paper entitled "Elastic Traction in the Immediate Treatment of Club-foot."

Discussed by Drs. Shaffer and Bartow.

Dr. W. E. Wirt read a paper entitled "Phelps' Method for the Cure of Club-foot in Adults."

A discussion on club-foot followed by Drs. Weigel, Townsend, Hingston (of Montreal), Coolidge, and Wirt.

Continuing the discussion on flat-foot, Dr. N. M. Shaffer read a paper entitled "Its Etiology and the Mechanism of its Production."

Discussed by Drs. Wirt, McCurdy, Ketch, Bartow, H. L. Taylor, Weigel, Gillette, Brackett, and Shaffer.

Dr. S. L. McCurdy read a paper entitled "Excision of the Knee by a New Method."

Dr. Ansel G. Cook read a paper entitled "Fixation and Traction in the Treatment of Fractures into Joints."

Discussed by Drs. Shaffer, Weigel, Ryan, R. F. Weir, and Cook.

Dr. W. R. Townsend read a paper entitled "Disease of the Shoulder-joint."

Discussed by Drs. Ketch, Shaffer, Ryan, Ridlon, and Townsend.

Dr. H. L. Taylor read a paper entitled "Infantile Scorbutus and its Relation to Orthopedic Surgery."

Discussed by Drs. Townsend, Ketch, Gillette, Shaffer, Ryan, and Taylor.

The Association then went into executive session.

Drs. Shaffer and Townsend then offered the following amendment to the Constitution:

Section 2, Article XI. "It shall, at the first annual meeting held after the adjournment of any Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as alternate."

Dr. H. L. Taylor moved, and Dr. Ketch seconded, "It is the sense of this Association that the term of the member-elect to the Executive Committee of the Congress of American Physicians and Surgeons begins after the next annual meeting of the Association." Carried.

The amendment to the Constitution, "*Resolved*, That the active membership be limited to sixty," presented by Drs. Shaffer and Ryan at the last annual meeting, was brought up and carried.

The following nominations for active membership were made:

Dr. A. R. Shands, of Washington, D. C., by Drs. Gibney and Townsend.

Dr. Stanton Allen, of Milwaukee, Wis., by Dr. Ridlon.

The following papers were read by title:

"The Treatment of Some Forms of Club-foot," by Mr. Edmund Owen, of London.

"Tarsoclasis for Club-foot," by Dr. Nicholas Grattan, of Cork.

"The Abuse of Phelps' Operation for Club-foot," by Dr. James E. Moore.

"Phelps' Method for Talipes Varo-equinus," by Dr. H. P. Kapteyn, of Abconde, Holland.

"Phelps' Method of Treating Some Forms of Club-foot," by Dr. Cordua, of Hamburg.

"The Place of Traction in the Treatment of Club-foot," by Dr. Newton M. Shaffer.

"Some Observations on the Anterior Transverse Arch of the Foot, and its Obliteration as a Cause of Metatarsalgia," by Dr. J. E. Goldthwait.

"The Treatment of Hip-disease and the Application of Lateral Traction," by Dr. R. W. Lovett.

"The Presentation of New Knee and Ankle-splints," "The New Improved Celluloid Corset," and "An Original Operation for Wry-neck," by Dr. A. M. Phelps.

"What Results Should we Try to Attain in the Treatment of Hip-joint Disease?" by Dr. Reginald H. Sayre.

"Lorenz's Operation for Congenital Dislocation of the Hip," by Dr. A. Lorenz, of Vienna.

"Congenital Dislocation of the Hip," by T. Halsted Myers.

"The Results in Talipes Varo-equinus after Phelps' Operation," and "Limits of Operative Treatment in Congenital Dislocation of the Hip," by Dr. Sigfred Levy, of Copenhagen.

"Peculiar Nervous Symptoms Occurring in Pott's Disease of the Spine," by Dr. Leroy W. Hubbard.

"Cervical Spondylitis," by Dr. A. J. Steele.

"The Treatment of Old Neglected Cases of Deformity following Poliomyelitis," by Dr. S. L. McCurdy.

"Infantile Apoplexy and Paralysis, and Some of their Consequences," by Dr. W. J. Little, of London.

"The Care of the Bony Frame in Infancy and Childhood," by Dr. J. B. Ransom, of Dannemora, N. Y.

"Diseases of the Knee-joint," by Dr. T. D. Griffith.

"Excision of the Knee for the Relief of Crippling from Infantile Paralysis," by Ap Morgan Vance.

"The Treatment of Rotary Lateral Curvature of the Spine by Non-restorative and Developmental Methods," by Dr. B. E. McKenzie.

"The Improved Machine for Treating Scoliosis," by Dr. Max Schede, of Hamburg.

"Scoliosis," by Dr. A. B. Hosmer.

"Excision of the Sac in Spina Bifida," by Dr. De Forest Willard.

"On the Application of the Principles of Extension in the Treat-

ment of Wry-neck," by Dr. William Adams and Mr. R. W. De Sante, of London.

"A Case of Ankylosis of the Jaw in a Child; Resection; Recovery with Good Motion," by Dr. Dillon Brown.

"The Methods of Recording Lateral Curvature," by Dr. E. G. Brackett.

"The Value of Fixation in Knee Disease," by Dr. G. W. Ryan.

"Amputation of Both Legs at the Knee-joints for Paralytic Club-foot and Spina Bifida," "Report of a Case, complicated by Congenital Inguinal Hernia, in which the Testis and the Appendix Vermiformis were Removed During the Operation for its Radical Cure," and "A Surgical Cot for the Treatment of Spinal Caries," by Dr. W. J. Taylor.

"The Pathology, Prognosis, and Mechanical and Surgical Treatment of Flat-foot, by Dr. T. G. Morton.

"Gymnastic Treatment of Flat-foot," by Dr. H. Augustus Wilson.

"The Etiology, Clinical History, and Pathological Conditions Producing Paralytic Deformities," by Dr. E. H. Bradford.

"Varieties, Diagnosis, Differential Diagnosis, and Prognosis of Paralytic Deformities, by Dr. E. G. Brackett.

"Mechanical Treatment of Paralytic Deformities," by Dr. John Ridlon and Dr. J. E. Goldthwaite.

"Operative Treatment of Paralytic Deformities," by Dr. De Forest Willard.

The minutes of the meeting were read and approved, and the Association adjourned.

The following members were present:

Wallace Blanchard, A. J. Gillette, Royal Whitman, Benjamin Lee, A. B. Hosmer, F. S. Coolidge, L. A. Weigel, Bernard Bartow, A. E. Hoadley, S. L. McCurdy, G. W. Ryan, A. G. Cook, W. E. Wirt, A. M. Phelps, John Ridlon, W. J. Taylor, E. H. Bradford, De Forest Willard, Roswell Park, Samuel Ketch, V. P. Gibney, T. H. Myers, Dillon Brown, Charles C. Foster, H. L. Burrell, J. C. Schapps, H. L. Taylor, W. R. Townsend, N. M. Shaffer, James Kerr, and E. G. Brackett.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

THIS Society shall be called the "AMERICAN ORTHOPEDIC ASSOCIATION."

ARTICLE II.—OBJECTS.

The purpose of this Association shall be the advancement of Orthopedic science and art.

ARTICLE III.—MEMBERSHIP.

SECTION 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

SEC. 2. There shall be three classes of members, viz.: Active, Corresponding, and Honorary.

SEC. 3. The number of Active Members shall be limited to sixty.

SEC. 4. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three mem-

bers, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars. Corresponding members shall pay annual dues of five dollars.

ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs, at the close of the regular meeting.

ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

ARTICLE XI.—THE CONGRESS.

SECTION 1. This Association shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the regular meeting held at the time of the Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all members present; provided that notice of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

BY-LAWS.

ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for fellowship, and shall be placed in the hands of the Secretary at least twelve months previous to the time of the regular meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged pre-eminence in Orthopedic Surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 6. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint the Committees on Membership and Publication, shall fill any vacancies that may occur from resignation or otherwise.

SEC. 3. The Vice-Presidents shall act in the absence of the President.

SEC. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

SEC. 5. The Treasurer shall collect all money due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

SEC. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

SEC. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work, and report the same to all members as early as practicable before the time of the annual meeting; it shall further manage such necessary affairs of the Association as are not already assigned to others.

SEC. 8. The Publication Committee shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and it shall have discretionary power as to matter for publication in questionable cases.

ARTICLE III.—ELECTIONS.

Elections of members shall be held at the first executive session of a regular meeting, and of officers at the last business session.

ARTICLE IV.—MEETINGS.

SECTION 1. The regular meetings shall be held annually during the third week in September of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

SEC. 2. Special meetings may be called by the Executive Committee or by the President at the written request of ten active members.

SEC. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

ARTICLE VI.—PUBLISHED PROCEEDINGS.

SECTION 1. The Transactions shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each except to those in arrears on Association dues.

SEC. 2. Additional copies of the Transactions shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

SEC. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

SEC. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the Transactions on the unanimous vote of the Publication Committee.

ARTICLE VII.—PAPERS AND DISCUSSIONS.

SECTION 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the

floor. The author of the paper shall be privileged to close the debate.

SEC. 2. No papers shall be read that have been previously published. Members publishing their papers after they have been presented to the Association shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary woodcuts.

SEC. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's correction. Marked changes from copy, known as "time work," shall be paid for by the author.

SEC. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for re-writing.

ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting, to wit: at noon of the first day, and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.
4. Election.
5. New business.

The last act before adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

ARTICLE IX.—AMENDMENTS.

Proposed Amendments to the By-laws shall be submitted in writing and signed by two active members. Previous notice of the proposed changes shall be given. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

THE PRESIDENT'S ADDRESS.

THE INFLUENCE OF SURGICAL BACTERIOLOGY AND MODERN PATHOLOGY UPON ORTHOPEDIC SURGERY, AND THE PAST, PRESENT AND FUTURE OF THAT SPECIALTY.

By A. M. PHELPS, M.D.,
NEW YORK.

Gentlemen: Undoubtedly the subject of modern surgical bacteriology and pathology has made, and will still further make, a most decided impression upon orthopedic surgery.

The discovery of the bacillus of tuberculosis, pus germs, and other forms of microscopic life, and their influence upon human tissues in a state of disease and health, has revolutionized surgical pathology and the treatment of wounds and lesions.

Among the older pathologists, inflammation was taught to be a diseased condition, and all of the various complications arising during the healing process were treated upon as a part of the inflammatory process.

The definition of inflammation given by Palmer, of the University of Michigan, covers nearly two pages of his book. In this definition he includes every process, normal and abnormal, which takes place in the healing of wounds, including suppuration and sloughing, which we now recognize as complications.

Inflammation is recognized by the advanced pathologist to be a perfectly normal process of repair. For example, when an incised wound is made, the first process that takes place is an effusion of blood and its coagulation, then a rapid wandering of cells into this blood-clot occurs, together with rapid cell proliferation. These cells form themselves into lines between the cut ends of the tissues, for

the purpose of repair. Very soon organization takes place, new tissue is built up. After this, contraction takes place, capillaries are destroyed, epithelium grows over the surface, and we say the wound is healed.

This is now believed to be the normal process of repair. This is inflammation, and the process is as normal as the growth of the stag's horn. This reparative inflammation is necessary in all cases where injury has been inflicted. If at any time during this process of repair or normal inflammation, germ life is inoculated, another condition is at once established, and that moment marks the beginning of disease. If these germs are pus germs, they at once seize upon this inflammatory material, and they, with their ptomaines, destroy the whole. The wound has become infected, and disease is the result. This disease is suppuration.

If the germs of tuberculosis should be inoculated into this new inflammatory tissue, their growth immediately takes place. No pus is formed from the bacilli of tuberculosis, but the germs grow and as surely destroy this new inflammatory material as did the germs of suppuration.

Then we say that this normal inflammatory material has become diseased, a tubercular inoculation, producing a tubercular focus or disease, is the result. Then there is a vast difference between inflammation and disease.

Should these germs be pyogenic and the inoculation take place in the bone, a very rapid osteomyelitis with abscess is almost sure to result. If, on the contrary, the germs of tuberculosis come in contact with this area of normal inflammation, then so sure will this condition be a tubercular one. The process is insidious, producing destruction by ulceration or caries.

After a time, should inoculation be present, the new inflammatory material is destroyed, and its place taken by germs and the products of germ life; but just outside of this area of disease a new barrier of normal inflammatory material is thrown up by the tissues, similar to the first. This is normal embryonic material, into which germ life rapidly grows and destroys, and so the normal process of repair goes on just a little in advance of disease, or germ invasion, until after a time, as in the head of the femur, or in the body of a vertebra, a large portion of bone is destroyed.

To produce disease caused by germs, two conditions are essential: First, inflammatory material, which is made up of embryonic cells, and second, the presence of germ life. In the absence of either, such disease cannot occur.

In a given case, an injury is received to the joint or spine. This injury may be very slight in character. From the fact that greater pressure occurs at the ends of bones, in the inter-vertebral cartilage, and spongy portions of the bodies of the vertebra, the lesion is more likely to take place at this point.

Immediately following a slight injury, Nature attempts repair by means of normal inflammatory action, but should there be floating in the circulation germ life, either tubercular or pyogenic, inoculation of this area of inflammation is almost sure to take place. When it occurs, if the phagocytes, which are the wandering and the fixed tissue-cells, are weakened on account of the strumous condition of the child, they fail to destroy the germ. The germs then destroy the phagocytes and convert the area of normal inflammation into disease, with the symptoms of which we are all familiar.

If, however, germ life is destroyed by the phagocytes, repair goes on uninterrupted as in any other wound, and, after a longer or shorter period, the parts are restored to their normal condition.

During the period of active inflammation the symptoms are almost identical with those of disease. Understanding this, we can now account for the ephemeral forms of hip and Pott's disease. Then the term osteitis, which is so frequently used, should not be applied to indicate a diseased condition, but rather a normal process of repair. The term struma should be used to indicate a condition. Struma is a condition. The reason why one child is attacked by tuberculosis and another escapes under similar circumstances is because one is strumous and the other not.

The difference between these two children is similar to that of the celery which is grown in the trench, kept away from the light of the sun, making the succulent plant fit for the table, and the other, which is grown in the sun, building up strong woody fibre. The tender celery, which has but little woody fibre, cannot resist the sting of the insect which deposits its larvæ, while the other with its woody fibre can. One is strumous, and the other not. The difference between them is only in degree and quality. So it is with the

strumous child. He has either inherited an enfeebled condition, or has acquired it through bad nourishment and bad surroundings. The protoplasm which makes up the phagocytes of his body is enfeebled, and differs from that of the strong, well-nourished child with a good ancestry. The phagocytes of his body, consisting of enfeebled protoplasm, do not resist the attack of germ life—the result is inoculation, destruction, and death; whereas, in the strong non-strumous child, phagocytes destroy the germ.

Then we must conclude that struma is located in the protoplasm of the ultimate cell of the body, and measures the resistance of the individual to the attack of germ life. This is struma!

The process which takes place after the inoculation of the bacilli of tuberculosis produces tubercular disease unattended with pus. Pyogenic germs produce rapid purulent destruction and the formation of abscesses.

Tubercular cavities or foci of disease may become inoculated with pyogenic germs, which result in the rapid formation of abscess. The growth of the bacilli of tuberculosis is slow, while that of the pyogenic cocci is rapid.

This explains why a child may carry around a fluctuating tumor filled with tubercular material that remains quiescent or possibly diminishes in size, when in a single day it increases, becomes hot and possibly painful, and very soon ruptures, with the escape of a large quantity of pus and cheesy material.

In such cases an inoculation of pus germs has taken place into the area of tubercular disease. The powder magazine of tubercular disease finally, after months, received the fatal spark which precipitated the abscess. Both tubercular material and pus possess the power of destroying tissue with which they come in contact. This explains the extensive destruction of joints when allowed to macerate for weeks or months in these materials. Understanding all this (and these facts are established beyond a question), we should not hesitate to decide what should be done in a given case, and the knife and drainage should be freely used. The term scrofula has become obsolete—tuberculosis has taken its place. The term scrofula was a makeshift word; it was the quacks' stock in trade. The term scrofula, alteratives, and many other terms in medicine are the breastworks behind which ignorance skulks.

It is to be hoped that we will never again see in print the terms strumous or scrofulous joints. The term scrofula means nothing, and struma is a condition. Infection may take place from within the body or from without. From within by germs floating in the circulation, which have been carried there by the lymphatics of the mucous membrane; from without by the direct entrance of germ life through the denuded skin. Of late it has been discovered that one of the most frequent sources of infection is from the milk of tuberculous cows. The inoculation of Koch's lymph detects animals infected. Whole herds of cattle have been killed recently after the demonstration with Koch's lymph, and in every instance the animals were found suffering from general or local tuberculosis. This being the fact, we should look to the feeding of our orthopedic cases. Undoubtedly relapses are frequently produced by inoculation from milk. A case is nearly cured; the bacilli of tuberculosis have been entirely destroyed in the healing process or become encysted; the normal process of repair is still going on, with its myriad of embryonic cells at work to complete a cure. At this stage, if a child drinks a glass of milk contaminated with the bacilli of tuberculosis, inoculation is almost sure to take place, and a relapse follows. To prevent this, animals supplying milk for patients or institutions should be examined. The milk should be sterilized; but this does not destroy the products of germ life, and this deleterious material does harm.

THE PAST, PRESENT, AND FUTURE OF ORTHOPEDIC SURGERY.

The history of *orthopedy* and orthopedic surgery, like that of general surgery, is humiliating. For many centuries general surgery struggled with the people and the priest for the high position which it now occupies.

It is only within a few years that surgery was divorced from the barber shop, and even to this day throughout Europe are seen in front of these shops the three small brass basins—the sign of the barber—used by his predecessors to catch the blood that flowed from his suffering patients.

'Tis true that all along through the dark ages of the past, when manacles were put upon the brains of man, occasionally a great light shown through the rifted clouds. The wonderful original work of men of the character of Galen, Ambrose Paré and others

was a particular bright star in the dark-domed firmament of ignorance and religious superstition. The influence of the labors of such men upon modern surgery can hardly be estimated. And so we can trace the history of *orthopedy* through the slough-holes of bigotry and jealousy almost from the time of earliest man. Their work was confined to the application of appliances to overcome deformity when it was not considered a sacrilege to do so.

In looking over the literature upon the subject one becomes bewildered. The armamentarium of the ancient *orthopedist* was, at least, the equal of our present appliances in point of ingenuity and intricacy. And the braces used at the present time bearing the names of modern men, supposed to be modern inventions, are nothing more or less, with but few exceptions, than the revival of the old ideas of the past.

The orthopedist was always at war with the general surgeon. There never was a time when they could lie peacefully together in the same bed, excepting like the lion and the lamb—one inside the other, and the poor *orthopede* was always inside. The orthopedist was a mere bandagist, adjusting his appliances to the lame and the halt, regardless of pathology or etiology, and the surgeon of his day was but little better.

But the science of surgery did progress, and it gradually made inroads upon the field of the *orthopedist*, and he soon saw many of his pet deformities, which had been to him through long years a source of pleasure and remuneration, filched by the skilful and investigating surgeon.

His failures in the treatment of club-foot and in many other deformities were well known to the surgical world, notwithstanding the boasted statements and the praise of patients cured.

The first tenotomies of Stromeyer began the beginning of the end of senseless mechanical work in certain forms of severe club-foot.

The work of McEwen, in more recent days, in bone deformities marks another era, and has taken from the *orthopedist* a large and important slice of his practice.

The work of Volkman, Koenig and others in joint diseases has made it extremely uncomfortable for the gentlemen who see nothing but a brace and strap for the treatment of such diseases. And so I might go on *ad infinitum* to show where general surgery has gradually made inroads upon the work of the *orthopedist*, until to-day

they have but little left; and this consists in the adjustment of braces to a very limited number of deformities, and frequently at the suggestion of the general surgeon, who condescends to operate for them when called upon.

These facts have stimulated to action another very important class of men who are known as *orthopedic surgeons*, and who claim that these deformities and many other diseases heretofore not included, and now treated by the general surgeon in a general way, come justly in their field.

These orthopedic surgeons believe in *orthopedic surgery*—they believe in mechanical work, whether by the adjustment of a brace or the use of the knife. They believe also that a thorough knowledge of pathology, surgical bacteriology and etiology is the only safe guide to treatment. They believe that a perfect knowledge of surgery and surgical laws is all important.

The combination of mechanical with surgical work constitutes *orthopedic surgery*. One divorced from the other makes general surgery and *orthopedy*. To illustrate:

Only a few decades ago the world was blessed or cursed with a specialist known as the oculist. He fitted glasses and did some other unimportant work about the eye. The general surgeon operated upon cataract, squint, removed the eyeball, and treated trachoma and other diseases of the eye. His field of work was so large that he had but little time to devote to the study of diseases of the eye.

A few of these oculists began the work, and, as a result, the world is now blessed with a most important special department of surgery known as ophthalmology. These men do all of the work of the older oculists. They adjust glasses. They have made grand discoveries in the ophthalmological world. They are in fact surgeon and oculist combined.

Less than half a century ago gynecology was limited to a few diseases of women, and the works of the older authors led us to believe that about all a woman was ever afflicted with was ulceration of the cervix. The gentleman who made his local applications and treated his patients with pills, pukes, purgatives, and pessaries, was known as a woman doctor. He was a general practitioner, and paid special attention to diseases of women; but his patients did not recover, and the general surgeon began to investigate his work.

Others also who had been women doctors began investigation, and the result is the grand specialty known as gynecology, and to-day the woman doctor is the gynecological surgeon, and he includes in his field not only ulceration of the cervix, but all of the diseases connected with the generative organs of the female, including the capital operation of cœliotomy.

The reason why these specialists took from general surgery the subjects which they now treat, is because, by special study and practice, they advanced and did better work and got grander results. These published results completely routed the general surgeon, whose time was too much taken to give special study to the subject. They won the battle in a fair fight upon the field of thought, and the profession of medicine awarded them the victory.

What, in your opinion, would have been the effect upon the specialty of ophthalmology if the gentleman away back there who fitted spectacles and was contented to be called an oculist had said: It is wrong for us to remove a lens, men who are educated as surgeons can do that? Suppose he, in his infinite stupidity, had said the adjustment of these glasses will cure the lens and return the sight, hence the knife is not to be used; it is wrong. Many of them did say just that. But investigators said we can improve upon the operation for cataract, and the cry was, give us more and better work. They discovered the cause, and their results won for them the confidence of the profession, and this specialty came to stay.

Where would gynecology be at the present moment if the general practitioner had continued his work. His practice would to-day be limited to his field of vision when applied through a speculum. But, thanks to McDowell, Battey, Emmet, Sims, Polk, Tait, Keith, Wells, Martin, Hanks, Dudley, and a host of others the field was widened, and their work won for gynecology the proud distinction it now enjoys in spite of the general surgeon. I might go on to illustrate with other important special departments of surgery and medicine, but time will not allow.

So we see that we are gradually drifting to that high standard of excellence attained by other departments of medicine, if we may be allowed to judge from the work of many of our most eminent orthopedic surgeons. We are forging ahead. We are rapidly becoming independent of the general surgeon and accepting his established

scientific facts. We are attaining a perfect knowledge of his operative methods and applying this knowledge, together with our mechanical methods, to the successful prevention and cure of deformities.

The question of what diseases or deformities are to be included in our specialty will depend entirely upon our results, and the general profession will be the umpire. Mr. Edmund Owen, of London; Kirmisson and Rédard, of Paris; Schede, Hoffe, and Beeley, of Germany; Lorenz, of Vienna, and Kaptein, of Holland, are among the orthopedic surgeons of Europe who believe in orthopedic surgery in all that word implies. In our own country, I am pleased to say, are many who believe the same.

One of the best definitions which has been offered for orthopedic surgery is that of Dr. Gibney, printed in the *New York Medical Journal*, November 7, 1891. It is: "that department of general surgery which includes the prevention, mechanical treatment, and the operative treatment of chronic and progressive deformities." But I can see no reason why acute joint disease attended with a deformity should not be treated by the orthopedist; then by adding the word "acute," it seems to make the definition a very good one.

The able text-book on *Orthopedic Surgery* by Prof. Hoffa does not include in its pages the subject of chronic joint disease. He does ~~not~~ include Pott's disease of the spine. Why include Pott's disease of the spine and not joint disease? In America the orthopedist and the orthopedic surgeon include in their list of orthopedic subjects both joint disease and Pott's disease of the spine. I cannot see why both should not belong exclusively to our specialty. Bradford and Lovett also include certain forms of paralysis in their recent text-book, with which I agree. And then, again, many members of this Association include in their work the treatment of fractures of the neck of the femur, and with them I fully agree. But why fractures of the neck of the femur and not all fractures? If all fractures are to be treated, why not dislocation? It is my earnest conviction that within a very few years fractures and dislocations will be treated by the orthopedic surgeon. These are conditions requiring the highest degree of mechanical knowledge and skill. Excisions of joints for chronic diseases, operations upon the spine for paralysis following Pott's disease, belong decidedly to the orthopedic surgeon, for the following reason:

Such cases are more frequently treated to-day, prior to excisions, by the orthopedic surgeon. And then, after excisions have been performed, mechanical treatment is necessary, covering over periods of months, and even years. Unquestionably, if all joint diseases of an acute or chronic nature were handed over to the skilful orthopedic surgeon, much better work would be done, and many a child would be saved from a cripple's life.

Working and teaching as I have for years in general surgery, I think I can speak, without prejudice to the general surgeon, upon this subject. I know that the general surgeon is too much occupied in his general work to carry out a prolonged treatment after his excisions; and then to hasten recoveries he is apt to resort to the knife when mechanical means would be better. These are the reasons why this class of joint diseases, either acute or chronic, should be forever claimed by the orthopedic surgeon.

All kinds of bone deformities requiring osteotomies or osteoclasis should be classified with orthopedic work. We readily see, then, that the orthopedic surgery of the future contemplates a wider field and the application more frequently of operative interference. If any orthopedic surgeon feels that he is not competent to do his work, let him call in the general surgeon. Let him do that for a few years, and he and his work will be seriously impaired.

Hernia unquestionably should be classified as an orthopedic subject. It is as important and as difficult to adjust a support to remedy a hernia as a splint to hip-joint disease, and frequently, by mechanical means, herniæ are cured.

In the Hospital for Crippled and Ruptured, New York, hernia is one of the diseases there treated, and it is recognized as an important part of their orthopedic work, and justly it should be. In the early history of that institution, cutting operations were, as I understand it, entirely dispensed with, not only for hernia, but all other deformities.

But under the present management the institution has been gradually raised to a higher plane, and to-day it ranks with our best institutions. I find now, when mechanical treatment fails in hernia, that an operation is performed to relieve the sufferer, and the same is true of joint diseases and deformities.

I visit Boston and its well-equiped Children's Hospital; there I witness similar work to that I now see in our best orthopedic

hospitals for the crippled and ruptured—operative work combined with mechanical, making indeed an orthopedic hospital, cared for by *orthopedic surgeons* and not *orthopedists*; and the work done by these institutions and the statistics which they will publish will go far toward divorcing many of the diseases which we now claim should be given to us from general surgery.

I visit other institutions in England, France, in this country, and especially in New York City, where surgical work is entirely dispensed with; where abscesses are allowed to burrow and sequestra in joints, to macerate in corroding pus, eventually either to kill the patient by infection or, fortunate for the patient, to be discharged as débris; where bow-legs and genu valgum in children of maturer age are still treated with braces, and patients suffering from suppuration regarded as hopeless or of doubtful recovery are transferred to other institutions to linger, and if recover, hopelessly crippled or more frequently die.

Fortunately for the profession, reports are published from all of these institutions which are an open book, and they who are not blind can read and judge of the comparative work performed. So enthusiastic was one of the advocates against non-surgical interference of joint disease that he made the statement upon the floor of the New York Academy of Medicine that "*in his report for the past year he was happy to say that of the large number of cases suffering from abscesses which had been treated in the institution where he had charge not one had been opened.*"

Publishing broadcast to the profession of medicine statements of this kind, printing statistics which are bristling all over with failures and unusually bad results, the large mortality in institutions where these cases are sent to die has done more to degrade orthopedic surgery to the low level which it found only a short time ago than all the ignorance of the dark ages of the past.

No member of this profession, be he orthopedist, oculist, or woman doctor of the past, has the right to violate well-established surgical laws, based upon scientific and clinical experimentation and laboratory truths, and he who does that will no longer drag these specialties down from the high pinnacle where a few men in this and other countries have placed them; but he will find himself floundering in

the mud and mire of condemnation so deep that his presence and work in our professional world will be ignored.

In the New York Post-Graduate School and Hospital the faculty a few years ago thought proper to establish an Orthopedic Department and in my opinion it is one of the wisest steps taken by that institution. A large portion of that beautiful building, which cost us nearly half a million of money, has been set aside for this work. Wards especially built, large dispensary rooms properly arranged, and convenient machine shops for the making of free braces for the unfortunate cripples, combine to make it a well-equipped orthopedic institution. The work in that department will give to it its character. Not only will mechanical appliances be adjusted there, but also, when necessary, operations performed. The staff of surgeons will strive to make that a department of orthopedic surgery, and shall hope to give from time to time to the profession of medicine data which may help to establish or disprove many theories.

The orthopedic surgeon of the future will be a man who has been thoroughly schooled in all the departments of medicine, who will have a perfect knowledge of pathology, surgical bacteriology, and anatomy. He will have added to this knowledge a general practice of at least twelve years. With all of these acquirements, and by his superior work, he will secure for our specialty the subjects which are rightfully ours. He will be fully competent to do orthopedic surgery as it should be done. He will be able to draw the line sharply and elevate his department as high as that of any other specialty, not excepting general surgery.

Orthopedic surgery when thus contemplated is a grand specialty. It is as important as that of general surgery. When this stand has been taken *colleges will want professors of orthopedic surgery.* We will no longer be called a society of buckle-and-strap men. We will include in our membership the best pathologists, general surgeons and anatomists that this broad Republic can furnish. The *orthopedist* will take the position that he chooses. The orthopedic surgeon will move on that high plane of scientific work which will not be the execration but the admiration of the entire profession of medicine.

THE RADICAL TREATMENT OF SEVERE TALIPES EQUINO-VARUS IN CHILDREN.

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However keenly some of the views set forth in the following paper may be traversed, this statement, I think, will be allowed to pass unchallenged: that the old-fashioned, or orthodox treatment of severe club-foot by subcutaneous tenotomy and the subsequent use of Scarpa's shoe left much to be desired. For my own part, I am prepared to admit that I found it entirely unsatisfactory in dealing with congenital talipes in hospital out-patient departments, and tedious, and ofttimes disappointing, in practice in the wards.

An important feature in the orthodox treatment of club-foot consisted in the subcutaneous division of the tendon of Achilles last of all. Thus, in the most recent edition of Erichsen's *Surgery*—to which book the surgeon naturally refers when in search of authority—we read as follows:

"After these (the tendons of tibialis anticus and posticus) have been cut across the tendo Achillis should be divided; but it is better in all cases to delay this for some weeks, as it steadies the foot, and thus facilitates the correction of the lateral displacement."

One element in the production of this unsatisfactory state of affairs is the unreasonable prejudice which so widely existed against getting to work at the earliest possible moment upon a congenital club-foot. But even after the Achilles tendon had eventually been divided, so much force had to be brought to bear upon the foot that the child was apt to suffer severely; and if the surgeon, or the dresser, or the nurse, persisted in its energetic employment, it was at the risk of producing an excoriation or even a slough upon the

instep. Thus, treatment was apt to become intermittent, and progress slow and painful. Moreover, operative interference under chloroform was likely to be required time after time, and the surgeon rarely knew when the case was perfectly cured and safe.

So the child was allowed to drift on; the tarsal bones becoming more misshapen, the fibrous structures more resisting, and the deformity more intractable.

Professor Sayre has done more than any one else to check this *laissez aller* practice, by insisting, in his own peculiar manner, that the treatment of the deformity should be delayed for no longer a period than is needed for the aforementioned attendant to wash his hands, and the monthy nurse the child.

I do not think that my experience in connection with the old-fashioned treatment of congenital club-foot has been in any way peculiar, but I must honestly admit that after operating on a child, and giving him much attention in the wards, and after supplying the parents with careful instruction as to subsequent procedures, I was very apt to find that child, some months later, an unwelcome applicant for further treatment. Indeed, I am sure that my experience cannot have been peculiar, for many children who have been under the care of other surgeons, and who have been submitted to the orthodox operative measures have, under the guidance of blind chance, found their way to me for supplemental help. I have little doubt, moreover, that failures of my own under the old treatment have sought orthopedic salvation in other hands.

I think it far less likely, however, but still not impossible, that some children whose congenital club-feet I have operated upon after Phelps' open and radical method have gone elsewhere for advice. After the operation has been once effectually performed the occurrence of inversion is improbable, even though some further drawing up of the heel may take place, for the operation has less control over the position of the heel than of the anterior segment of the foot—less beneficial influence over the equinus than over the varus. (The vertical scar upon the inner border of the foot would show that the open operation had been resorted to.)

That which I have called the orthodox treatment of club-foot (as opposed to the radical method) was based upon the theory that it was inexpedient, if not dangerous, to divide a shortened tendon

or band of fascia, except by means of a slender blade introduced through the smallest possible opening in the skin.

But in these days of surgical cleanliness the operator perfers to know exactly what he is dividing; to have his eye or his finger always in advance of his knife. He has less dread of incising the skin than the surgeon of the past generation had of even pricking it.

However vigorously the knife may have been used in the anatomical darkness of a subcutaneous operation, the complete effacement of the deformity is effectually hindered by the skin, which is not only thick and resisting, but is closely connected with the subjacent plantar fascia.

An essential feature in Phelps' operation is that the skin is freely incised, so that on the completion of the operation nothing whatever is left to oppose the thorough effacement of the deformity.

Preparation.—It is hardly necessary to insist that at the time of the operation the patient should be in the best possible health; and for this purpose he may be kept under observation for a few days before operating. The day before the operation the foot is well soaked and washed. And on the morning of operating it is again washed in soap and water, and then with a 1 in 2000 solution of perchloride of mercury. After this, and till the surgeon is ready, the foot is kept enclosed in wet antiseptic cloths. No Esmarch's band or other form of tourniquet is used. Each bleeding-point is seized by the catch-forceps as it attracts attention, but, as a matter of fact, the amount of bleeding is far less than might have been expected. Perhaps one or two small vessels may need temporary pinching with the self-holding forceps, but it is quite exceptional for more than one of them to need a ligature. Phelps, however, operates with an Esmarch bandage.

The instruments required are a tenotomy-knife for the tendon of Achilles; a medium-sized scalpel, a pair of dissecting forceps, a few pairs of catch-forceps, a pair of scisors, and a steel director. No specially designed knife is needed.

Operation.—An anæsthetic having been administered, the foot is uncovered, the amount of resistance and deformity is estimated by forcible manipulation. The tendon of Achilles is then divided subcutaneously, the foot being flexed to the utmost and brought into the best possible position.

For many years, and quite independently of Phelps' innovation, I have been in the habit of beginning all operations for equino-varus by the division of the heel tendon. The influence of this tendon is by no means confined to the elevation of the heel; having contracted, as it were, to the utmost in drawing up the heel, the tendon obtains a still further shortening by rotating the os calcis inward on its antero-posterior axis. Thus, its division reduces, and in some slight cases actually effaces each element of the congenital deformity. Such cases, however, do not enter into the class of those for which I am advocating the adoption of Phelps' operation; they may be efficiently dealt with by the far simpler procedure. But I would like to insist on this: that in all cases of equino-varus, whether the surgeon contemplates the adoption of the subcutaneous or the open operation, he should begin by dividing the Achilles tendon. After this tenotomy the foot should be flexed with great force to a right-angle, when, if a considerable amount of deformity still persists, the radical operation may be proceeded with unless, indeed, a milder course of treatmemt appears to offer an equally favorable result.

The next step in the operation consists in making a free vertical incision from dorsum to sole of foot, between the tip of the internal malleolus and the tuberosity of the scaphoid. This passes across the head of the astragalus, and the top of the incision brings into view the internal saphenous vein and the tendon of the tibialis anticus. The vein is generally sacrificed. Section of the tibialis anticus tendon is not necessary, for the heel having been already brought down, the structures at the front of the ankle are necessarily slackened—the anterior tibial tendon amongst them.

Attention being then given to the lower part of the incision, the plantar fascia—comparatively thin as it covers the abductor hallucis—is divided, and probably a good deal of that muscle. The strong piece of the fascia over the flexor brevis digitorum is cut, and, in an extreme case, some of the short flexor itself.

The tendon of the tibialis posticus is next sought in the depths of the wound, and, on its division—the foot being still further straightened out—the tendon of the flexor longus digitorum, which lies close to its outer side, may invite section. At about this period of the operation the anterior part of the internal lateral ligament

may be dealt with. It is an element of the highest importance in keeping up the cramped position of the inner border of the foot, running, as it does, from the front of the internal malleolus—over the head of the astragalus—to the scaphoid bone. The old-fashioned subcutaneous operation entirely failed to cope with this difficulty.

After the front of the deltoid ligament has been freely traversed by the scalpel, and, by the help of more forcible manipulation, the foot has been further straightened out, the scaphoid must needs be pulled forward from the astragalus, the astragalo-scaphoid joint being left wide open. Placing the end of the finger into this joint, the surgeon may distinctly feet the fibres of the inferior calcaneo-scaphoid ligament maintaining some deformity. When these have been divided, some of the inner fibres of the calcaneo-cuboid ligament may be found to want a touch of the scalpel. In short, every structure must be cut which prevents the full and unobstructed straightening of the foot.

When the bleeding has been controlled—and it is usually quite insignificant—the wound and the foot are washed over with a warm mercuric solution (1 in 4000), the yawning incision is gently stuffed, and the foot is enveloped with mercuric gauze, and the foot and ankle and the lower part of the leg are enclosed in a flannel bandage. Two lateral splints of common house-flannel are then soaked in creamy plaster-of-Paris, and are firmly and evenly applied under a gauze bandage. During their application and hardening the foot is held in the over-corrected position, good heed being given that the plaster casing is not dented in by any uneven pressure of the thumb or fingers. The toes are left uncovered for inspection, so that early information may be obtained of obstructed circulation.

I confess that in some of my earliest operations I was apprehensive lest the anterior segment of the foot might show signs of threatening gangrene, not only because of its being rigidly confined in the gypsum casing, but because of the depth of the wound which traversed the tissues from dorsum to sole. Practice, however, has shown such fears to be groundless. The casing, though rigid, is not actually tight, and although the internal plantar artery may perhaps be cut in the operation, the dorsalis pedis and the external plantar artery, which are of far greater anatomical importance, run

no chance of being injured. But, small though the internal plantar artery is, it may sometimes be recognized in the progress of the operation, and avoided.

The child suffers but little distress after the operation, and on one occasion only did a house-surgeon deem it advisable to remove the dressings to examine the foot. In that particular instance the toes had become blue and cold; but a fresh casing was at once applied, and everything went well. As a rule, the first dressing is done at the end of ten days or a fortnight. The casing is opened out, the bandages are cut up, and the mercuric gauze, already loosened by a little aseptic discharge, lifted out of the wound, the surface and depths of which are thickly covered with healthy granulations. The foot is then washed and lightly dressed as before, and again secured in plaster-of-Paris. In four or five weeks, or a little more, the wound is completely healed, and the treatment by manipulation and massage is entered upon.

We all know how carelessly or imperfectly instructions as regards manipulation and massage are carried out by parents when a child is under their unsupervised control; it is a severe and crucial test for the value of this radical operation that when the child is brought for inspection, at the end of some weeks or even months, the foot is found in a very excellent position. If it still shows more inversion than is desirable, it is at once seen that this defect can be corrected with the least possible application of force.

Time after time I have asked the sister or nurse of a ward if the child seemed to suffer from the position in which the foot is left, and the answers which I have received have left me well assured that the change of position causes little or no distress, for the simple reason that it is kept up without any force or strain. There is no strain because every resisting band has been severed.

The deep wound which the operation leaves upon the inner aspect and in the sole of the foot at the mid-tarsal joint soon fills up with granulation-tissue, which, in due course, becomes converted into firm scar-tissue. The subsequent contraction of this new material is rarely strong enough to reproduce or to perpetuate the inversion of the foot. It does prove sufficient, however, firmly to weld the anterior with the posterior segment of the foot, and to render the corrected foot serviceable for flat standing and for pro-

gression. The sooner the patient can be got to walk upon the flattened foot the less is the risk of even a slight amount of inversion recurring. I have the children stumping around in the gypsum boot within a week of the operation.

In the progress of cicatrization a firm fibrous splice is inserted in each one of the divided tendons and ligaments. And I apprehend that the widened space between the astralagus and scaphoid is filled in with the same material. Probably it is the interposition of this thick medium between the two segments of the foot which renders the parts so strong and trustworthy when all is healed.

In one very severe case of equino-varus, when almost every structure which one expects to encounter in the radical operation had been divided, and the foot still resisted easy adjustment in the correct form, I found that the impediment came from the tendon of the peroneus longus. Having exposed this in the depths of the sole, and having divided it, the foot at once came easily into position.

I confess that if a candidate at examination told me that the tendon of the peroneus longus was one of the structures needing division in the operation for the cure of talipes equino-varus, I should be inclined to think that his statement was based either upon a misapprehension or upon ignorance. But, as a matter of fact, this tendon may have a great deal to do with the perpetuation of the congenital deformity. When a foot has long been cramped with an inverted sole, an elevated heel, and a contracted internal border, this tendon may very likely be found at fault. And the greater the previous elevation of the heel the greater may be the need, after dividing the tendon of Achilles and flexing the foot, of severing the tendon of the peroneus longus.

The peroneus longus is an important extensor of the foot, and when, after Achilles tenotomy, the deformed foot is forcibly flexed, the peroneal tendon is tightened up and is holding the base of the first metatarsal bone as closely as it can toward the heel. In other words, it is dragging the scaphoid against the head of the astragalus. And as it is the surgeon's object in performing the open operation to insert a thick wedge of space between the astragalus and the scaphoid, and to be able to maintain that space without the exertion

of any considerable force, the tendon of the peroneus longus may need to be sacrificed.

I have not directed attention to this anatomical detail with the idea of suggesting that in the performance of the open operation the surgeon must expect to be called upon to divide this particular tendon, but rather with the view of emphasizing two statements: First, that a surgeon cannot expect to deal effectually by a subcutaneous operation with every resisting structure in the depths of the sole; and, secondly, that he must be prepared to sever, in his open wound, every structure which he finds offering obstruction to the perfect and easy correction of the deformity.

An important element in the open method, and one to which Phelps strongly refers, is the need of "over-correcting" the deformity—if I may once more be allowed that expression. In the old operation the surgeon was contented to lay down his tenotomy-knife when, by the employment of a fair amount of force, he could bring the foot into a good position. He was contented to leave a certain amount of the deformity to be effaced by the subsequent employment of Scarpa's shoe or of some other retentive apparatus. But now, after operating according to Phelps' method, he fixes the foot in a gypsum casing a good deal in the position of valgus, if not of calcaneo-valgus. As a sailor might say, he gets "well to wind'ard" of the original defect.

In the paper which he read before the Berlin meeting of the International Congress, Phelps wrote that he had never found it necessary to resort to the open incision in children under one year of age. Had he postulated that the operation is not suited for infants, I would, in that one particular only, have joined issue with him. In suggesting the field of usefulness of an operation the age of a patient is without value as a definite landmark. Age is a purely relative term, and I fail to see why an operation which is good for a boy of eight years is unsuitable for one of eight months.

Indeed, I have operated on an infant of eight months after this radical method, and with the most satisfactory results. This particular child was born with talipes equino-varus in the private practice of a former house-surgeon at the Children's Hospital, Dr. Bays, who had corrected much of the deformity by Achilles tenotomy. He was familiar with the open method of treatment, and

he called me in simply that the remaining deformity of this sturdy infant might be effectually dealt with once and for all.

Granting that the principle of the operation is good, I fail to see how the tender age of a child with congenital club-foot can of itself be a barrier against its adoption. What the surgeon desires is to correct the deformity at the earliest possible moment, with the least possible distress to the child, and with the greatest possible chance of shutting out the risk of relapse. For my own part, I have no "age limit," but I trust that it is superfluous for me to insist that I would not advise the open operation in a case which gave a fair prospect of yielding readily to simple subcutaneous tenotomy, with adjustments and massage; especially (as more frequently happens in private practice) when the child can be kept under the prolonged supervision of the operating surgeon and under the well-directed manipulations of intelligent nurses or parents.

In one very severe case of relapsed equino-varus, after dividing all those fibrous structures which chiefly opposed the desired position of the foot, I deemed it expedient to complete the treatment of the open method by removing the astragalus. But the necessity of resorting to a tarsectomy in conjunction with the open operation, at any rate in the case of children, must be very rare.

In a certain number of his cases Phelps has completed the open operation by dividing the neck of the astragalus, and in a smaller proportion he has gone a step further, and has removed a wedge from the outside of the os calcis. Of these modifications I have at present no personal experience, but I do not think that section of the neck of the astragalus can give much advantage over the insertion of a thick wedge of space into the astragalo-scaphoid joint. And if one is too ready to excise a piece of the os calcis there will be a risk of obtaining an improved position of the foot by the shortening of its outer border, rather than by the lengthening of the inner border. Still, I would not for a moment suggest that the open operation is never to be supplemented by a tarsectomy. Indeed, I think otherwise. But in the case of children (to which class of patients these practical observations are confined) the simple but thoroughly free incision on the inner side of the foot will usually be found to be sufficient. And if the result of treatment

by lengthening the inner border of the foot can eventually be shown equal to that following the removal of a wedge of bone from the outer border, preference must surely be claimed for the simpler method.

Kirmisson records a case in the *Journal de Médecine* (Jan. 1890) which he successfully treated by Phelps' operation in which relapse had occurred after the performance of Lund's operation of removal of the astragalus. This I can well understand, for even after the removal of this bone the inversion of the foot in an extreme case is by no means effectually dealt with, unless, at the same time, the front of the deltoid ligament and the adjacent tendons are also severed. And I am entirely in agreement with Kirmisson when he says that the thorough and open method of Phelps will probably render the removal of the astragalus, and tarsectomies in general, very exceptional procedures in the treatment of club-foot. Indeed, Phelps himself, at the Berlin Congress, insisted that osteotomy should never be resorted to as a primary operation.

On the same occasion he also remarked that in none of the cases on which he had operated had a sensitive scar, a flat-foot or a local paralysis detracted from the usefulness of his treatment. And in a private note Dr. Phelps recently informed me that he had then performed the operation 200 times without a death. In 11 per cent. of these operations he had also supplemented the open treatment by an osteotomy.

So far as my own experience with the radical or open treatment goes (and I have practised it in a considerable number of severe cases of equino-varus during the last few years) I have every reason to speak well of it; and it is with the hope of bringing it into more general notice, as well as of learning the views which other surgeons hold concerning it, that I have ventured to bring the subject before the Society.

TARSOCLASIS.

By NICHOLAS GRATTAN, F.R.C.S.,
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In a paper which I had the honor of presenting to this Associaciation in 1892 I gave the results of a few cases of crushing the tarsus for resistant club-feet.

Up to that time I had been so fully occupied in investigating the treatment of deformity of the long bones with an osteoclast that I had not given the operation as much attention as I wished. On my return home I determined to give forcible instrumental rectification a full trial. I may say that I experienced great difficulty, and much time was lost in obtaining an instrument which would satisfactorily perform my work. I procured a Thomas club-foot wrench, with a lever quite twenty-four inches long, the bars of which were of polished steel and uncovered.

I used this powerful wrench on several children, but it proved insufficient to overcorrect many of the feet which came under my care; neither could I with the osteoclast which I exhibited to you in 1892 sufficiently overcorrect some of these cases. I therefore had a more powerful osteoclast manufactured, which, after many months spent in experiments and failures of all sorts, has assumed the following form:

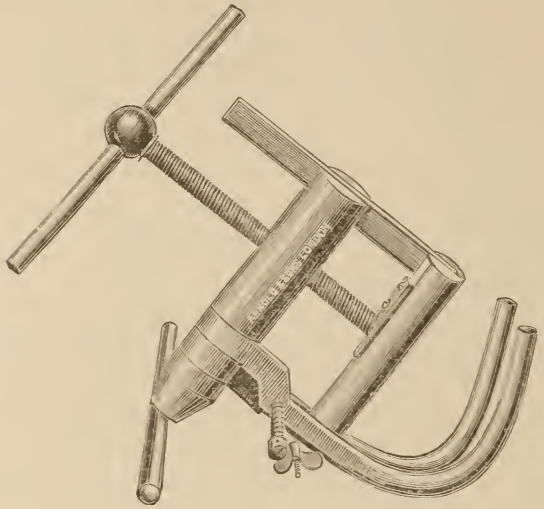
Except that it is a much more powerful and accurate instrument, it very much resembles the osteoclast exhibited to you.

The screw is one inch in diameter, contains five square threads to the inch.

The lever by means of which the screw is actuated is eighteen inches long.

The central pressure-bar is prevented from rotating when the screw is turned, by means of a strong guide-rod attached to it,

which works through the spindle parallel to the screw. The pressure-bar is one and one-eighth of an inch at its broadest part, and is so arranged with regard to the opposing bars that it can be moved a considerable distance toward the spindle, guided by and between



these bars. The pressure-bar, therefore cannot slip off the convex surface of the foot, neither can the opposing bars open, so that it is possible to reduce the distance between these bars to one and one-eighth of an inch, and a very small foot indeed can be operated on.

Owing to the opposing bars presenting a curve, and the central bar being straight, it is possible to overcorrect and stretch one border of the foot more than the other.

This instrument as now arranged weighs about forty-five pounds. It is an excellent and reliable osteoclast. I have found it a most satisfactory and accurate tarsoclast. Owing to the guide-rod which is attached to the central pressure-bar it is possible to operate without assistance. With regard to its power, I have torn open the tarsus on the inner side of the foot of a girl aged fourteen and a half years. It has been tried on a cadaver, a man, forty-five years old; both femurs and legs were easily broken. The fractures were found to be transverse and subperiosteal.

The instrument is used in the following manner: By means of

the side screws the opposing bars are fixed at the desired distance, which for young children is generally one and a quarter to one and a half inches apart. The screw having been reversed, and the central presure-bar drawn back, so that the foot can be easily introduced between the pressure-bar and the opposing bars, the os calcis and the concave surface of the tarsus are held against the two opposing bars. On turning the levers the central pressure-bar is pressed on the convex surface of the tarsus, until it, the tarsus, is crushed and bent, so that the foot presents the form of an aggravated flat-foot. This procedure is repeated two or more times *until all resistance ceases*, or until the tarsus has been fractured. The foot enveloped in cotton-wadding is put up overcorrected in a plaster-of-Paris bandage.

My endeavor has been to produce a fracture of the tarsus, as I find from experience that when a bone has been bent or partially fractured it has a great tendency to return to its former shape. Bones are very elastic, the bones of the tarsus more so than the long bones. Like cork, when compressed, they constantly expand to their old form. As a rule, no wound results from the pressure; there is no abrasion, and after twelve hours the patient is free from pain. When a week has elapsed, the bandage is removed, and the foot examined. If it *still resists*, the foot must again be overcorrected by the hand, or with the tarsoclast, and again encased in plaster-of-Paris bandage.

The cases which I have lately treated with this instrument had all resisted manual stretching and forcible rectification with a Thomas wrench. In many of them astragalectomy had also been performed, but still the deformity was not sufficiently corrected to enable them to walk with comfort. By this method of treatment their feet have been corrected, and for a time at least they have been enabled to walk with their feet flat on the ground. Should I find them relapse into the old position I shall again forcibly correct them. With this instrument I have also successfully overcorrected a most severe case of flat-foot in a girl aged fourteen and a half years.

With regard to this method of treatment I have come to the following conclusions: That in forcible instrumental rectification with a tarsoclast we possess a powerful and ready means of correcting the deformities of club-feet which have resisted treatment by manual

stretching or by the Thomas wrench; that in order to succeed by this method it is necessary to sufficiently overcorrect, or, if possible, to fracture the tarsus; that the operation should be repeated at intervals until *all resistance* ceases, and the foot has resumed its normal position, without any tendency to relapse; tenotomy of the tendo Achillis should also be performed should the equinus persist; that it is possible by these means, combined with osteoclasis of the tibia and fibula close to the ankle-joint, and rotating the foot outward, to enable patients to walk whom astragalectomy has failed to cure; that flat-feet can be easily corrected by forcible instrumental rectification.

Patients Treated with Improved Osteoclast.

E. O'C., aged three and a half years; club-feet. When three months old, manual stretching and plaster-of-Paris bandages until up to the age of two years, when she was beginning to walk with elastic bands to outer edges of her feet. At this age her left foot was quite cured, but the right foot continued resistant; she walks on outer edge of foot—slight equino-varus. Wrenched with Thomas's wrench at intervals.

October, 1, 1893. Is walking. Right foot continues resistant. Tenotomy of tendo Achillis, this was followed by crushing right tarsus.

November 3. Is doing well.

February 9, 1894. Right foot relapsing. Overcorrected it twice during a fortnight with the osteoclast. Plaster-of-Paris bandages.

March 7. Walking about, much improved.

April 26. Foot is well-shaped, but slightly inverted; walks pretty well.

William D., aged three years; club-feet (resistant).

August 18, 1891. When three weeks old, manual stretching followed by crushing his right tarsus. Plaster-of-Paris bandages.

December 31. Feet well shaped, elastic band to outer edge of feet.

October 25, 1893. Has been treated by manual stretching at intervals, also elastic bands to outer edge of feet; is relapsing; walks on outer edge of both his feet.

November 3. Crushed both his tarsi.

December 6. No improvement; again crushed both his feet. Plaster-of-Paris bandage.

March 21, 1894. Is doing pretty well; manual stretching; feet well shaped, there is but little resistance. Plaster-of-Paris bandages.

April 26. Much improved by treatment; there is no resistance.

Julia McC., aged fourteen and a half years. Left talipes equinovarus (paralytic). Right talipes valgus.

November 23, 1893. Removed left astragalus, also portions of the os calcis.

February 21, 1894. Quite recovered, but slight varus remains. Forced her right foot into shape with the osteoclast; applied plaster-of-Paris bandages.

22*d*. Had but little pain.

March 17. Overcorrected her right foot again, applied severe pressure, lasting quite sixty seconds; anterior of foot much blanched. Plaster-of-Paris bandages applied. With the osteoclast partially corrected her left foot; the skin between the opposing bars was torn open; wound similar to Phelps' open incision.

April 1. Wound healed; doing well.

15*th*. Assisted by Mr. E. Muirhead Little, again overcorrected her left foot with osteoclast. The tarsus was torn, and there was a large skin wound as before; applied a splint and an absorbent dressing.

26*th*. Wound quite healed; there is much improvement in the shape of her foot.

Michael D., aged six years. Resistant club-feet.

March 9, 1891. When three years old, astragalectomy of both his feet, followed when he had recovered, by osteoclasis of both his legs quite close to the ankle-joint. His feet were rotated outward until his great toe and inner border of patella were in a line, the inner borders of his feet were forced downward, thus correcting the slight varus which remained.

January 29, 1892. He walked fairly well after these operations, having an elastic band to outer edge of feet.

January 28, 1893. Tendency to relapse. There is slight varus of both his feet. Crushed both his tarsi into shape, after which he walked fairly well.

February 28, 1894. Relapsing; walks fairly well; left foot

slight equinus; right foot considerable varus. With osteoclast fractured right tarsus, overcorrected it; overcorrected left foot also (osteoclast). Plaster-of-Paris bandage.

March 17. Overcorrected left foot (osteoclast).

April 26. Both his feet are well shaped; ordered to walk about.

Edward M., aged three years. Club-feet. Resistant.

July 4, 1892. When eighteen months old ruptured and crushed left tarsus with osteoclast; manual stretching of right.

21*st*. No improvement. Astragalectomy both feet.

January, 1893. Wounds had healed readily. There is considerable equino-varus both feet. Crushed both his tarsi. The result very unsatisfactory.

April 20. Is beginning to walk; tendency to relapse. Manual stretching.

December 13. Again crushed both his feet and severely overcorrected them; plaster-of-Paris bandages.

March 22, 1894. Left foot pretty well, considerable varus right foot. Succeeded in fracturing his right tarsus with the osteoclast, also overcorrected his left foot. Plaster-of-Paris bandage.

April 26. Feet are well shaped, and keeping so.

C. C., aged nine months. Club-feet. Resistant. Soon after birth commenced manual stretching; plaster-of-Paris bandage; no improvement.

February 9, 1894. Feet resisting, overcorrected them with the osteoclast; plaster-of-Paris bandage.

March 7. Slight resistance left foot, no resistance right; manual stretching. Both feet easily overcorrected; plaster-of-Paris bandage.

April 26. This child is doing well.

Willie B., aged thirteen months. Severe resistant club-feet.

April 19, 1894. Assisted by Mr. E. Muirhead Little, overcorrected both his feet; pressure was continued until the inner edge of both his feet were torn; the skin tore in the line of Phelps' open incision. Put up both feet in an absorbent dressing.

26*th*. Wound healed without any trouble; the varus is corrected.

ABUSE OF PHELPS' OPERATION FOR CLUB-FOOT.

By JAMES E. MOORE, M.D.,
MINNEAPOLIS.

THE treatment of club-foot is a very delicate subject with general practitioners, because most of them have some failures to record, and very few of them have ever treated a case successfully. It is, therefore, very natural that anything new in the way of treating these cases should attract their attention, especially when it smacks of heroic surgery, as does the treatment by open incision so ably advocated by our worthy President, Dr. Phelps.

I have feared from the time when this operation was first brought prominently before us, that the profession would follow its well-known tendency and fly from its extreme conservatism in the treatment of club-foot to the other extreme; and while this change has not been as marked as I feared it might be, it has been decided enough to call for a note of warning. When I first noticed that this valuable operation was being overdone I hoped that the abuse was only among my overzealous Western confrères, but upon visiting clinics in Eastern cities I found that general surgeons were pretty generally cutting club-feet wide open, whether they needed it or not. If there is any one thing that is pre-eminently orthopedic it certainly is club-foot, and overzealous operators will find to their sorrow that every effort to lift it out of that domain will fail. If this operation solved the whole of the difficult problem of the treatment of club-foot we would all welcome it, because it is so easily and so quickly done; but everyone who has a thorough knowledge of orthopedy knows that this, like every other operation, has its limitations. We should no more resort to open incision in every case of club-foot than we should to excision in every case of hip-joint disease, and yet I know of surgeons of good repute who never treat

club-foot any other way. When asked if they do so because they believe that this is the only proper way to treat these cases, they frankly admit that their reason is that by this method they occasionally meet with success, while by other methods they invariably meet with failure. After a time, when these operators find that many of their apparent successes were ultimately failures, because of their lack of proper after-treatment, they will realize that all operations are but the beginning of the treatment of a case of club-foot. That failures and relapses do occur after this operation I can testify, for I have had a number of cases come to me for treatment. The cases cured by surgeons who have not had proper orthopedic training are usually very simple cases that should not have been operated upon. It is not necessary to say to the members of this Association that every case of club-foot operated upon, no matter by what method, must have after-treatment to prevent relapse; but this operation is being abused by outsiders, inasmuch as they apply it indiscriminately and do not follow it with proper orthopedic treatment; and it is our duty to call their attention to the fact that their failures are not due to the operation *per se*, but to their depending upon the operation to cure their cases, to the exclusion of everything orthopedic.

It is very easy to understand that the natural tendency is to relapse after open incision, because scar tissue always contracts, and because the bones of the tarsus do not fit in their new position. To make this operation a success, therefore, it is always necessary that after-treatment be kept up until the bones have grown so that they fit in their new position, and until the scar tissue on the inner side of the foot has ceased to contract.

I believe that it is pretty well established that open incision should, as a rule, be performed only when the deformity cannot be overcome by force and subcutaneous cutting. I say as a rule, because I believe there is at least one exception. In cases of congenital club-foot, where the skin is as smooth and unwrinkled on the inside of the foot as on the outside, where there are no dense contracted bands preventing reductions of the deformity, where there is no undue projection of the tarsus on the outer side of the foot, where the deformity can easily be overcome with the hands, and when, notwithstanding all these indications of a case easily

cured, the foot persistently returns to the abnormal position as soon as the apparatus is removed, just as if Nature had intended that it should always remain so, I have found open incision followed by good results when everything else had failed.

In performing this operation I cover the wound with a piece of rubber tissue and allow a blood-clot to form. The dressings are allowed to remain for one month, when the wound is invariably found to be completely healed.

PHELPS' METHOD FOR TALIPES VARO-EQUINUS, AND THE RESULTS IN MY PRACTICE.

By H. P. KAPTEIN, M.D.,
ABCOUDE, HOLLAND.

At the Tenth International Congress, which met at Berlin, I there reported the results following Phelps' operation in Holland. I then succeeded in collecting forty-two operations in thirty-two cases. In this series, thirty-four were very good results; one materially improved; fair results in six, and one still under treatment. In thirty-six feet the results were almost perfect, and in all of the others, excepting one which is unknown, the feet were very useful.

These statistics were compiled from the works of Professors Tilanus, Korteweg, Tterson, and Drs. Van der Hoeven, F. Kouwer, Dunnewold, and myself.

At the same Congress there was read by Prof. Phelps a paper on the "The Present Status of the Open Incision Method for Talipes Varo-Equinus," in which he reported 161 operations performed in 93 cases. There were in this series of cases 117 of blood-clot organization, 4 of catgut, and 19 failures in 140 cases where that method was attempted. On the fourth month after operating the feet were all straight. Out of 140 cases traced after one year, 10 cases were found relapsed, or partially so, from neglect. There were performed 10 linear osteotomies, 5 linear osteotomies with cuneiform resection from the os calcis or cuboid, and 2 linear or cuneiform osteotomies, together with removal of both cuboid and scaphoid bones, making in all 17 osteotomies, or about 10 per cent.

These results very closely correspond to my own, and lead me to believe that primary osteotomies should certainly be abandoned; that 90 per cent. of all cases of severe forms of club-foot may be straightened, with better results, without osteotomy.

The results in my series of cases have been all that I could ask for. During the past few years I have seen but few cases of severe club-foot to deal with. It seems that the communications of Phelps at Copenhagen and Berlin started in many parts of Europe a very great activity in the treatment of club-foot after his method. As a consequence, we now meet fewer and fewer cases of inveterate club-foot. The newly-born are mostly treated by fixation apparatus in overcorrected position. I treat my cases of newly-born children with club-foot with gypsum bandages, with good results. The ages of my patients treated by Phelps' method have been between nine months and fifteen years. Most of the cases were double-pes varo-equinus ; three only had club-foot on one side. In none of the cases, not even in the most distorted ones, was I obliged to make incision or excision of tarsal bones. After cutting very freely the contracted tissues, in some cases to a very great extent, the reposition of the foot in an overcorrected position, as taught by Phelps, was always possible, and even easy. The broad and deep wound was treated with strict antiseptic precautions, and stuffed up with iodoform gauze. The healing of the broad and deep wound was uninterrupted in all my cases. The new tissue which formed added to the shortened side of the foot, and, holding the foot in the overcorrected position for a long time prevented relapse. There never was any febrile reaction. In four of my cases I was obliged to divide the deltoid ligament along the circumference of the malleolus internus. This was unavoidable to attain overcorrection of the foot in the valgus position. The after-treatment, which I consider to be of the utmost importance for obtaining perfect results, was continued for a long time. In one of my cases I had to correct, after the healing of the wounds, curved tibiæ on both sides. Shoes with steel supports up to the pelvis and a leather belt around the abdomen corrected this deformity.

In my second case, a girl of thirteen years, the result was all that could be wished. There was in this case great atrophy of the leg and progression on the dorsal surface of the foot. Very free division of all the contracted soft parts enabled me to put up the foot and leg in overcorrected position in a bandage of plaster-of-Paris. The result was perfect and has remained so (that is, several years) ; the atrophy of the leg is much less than it was formerly.

The foot, which is used perfectly and in an abducted position, remained a little smaller in dimensions than its comrade.

In several of my subsequent cases the results were perfectly ideal, and left nothing to be wished for. Generally speaking, I declare that I am perfectly content with the results of this operation in my hands. In some of my cases the patients, after the healing of the wounds, though putting the soles of their feet perfectly on the ground when they were walking, had a slight adduction of the toes and the front of the foot. This deformity was easily corrected by appropriate shoes.

PHELPS' METHOD FOR THE CURE OF CLUB-FOOT IN ADULTS.

By WILLIAM E. WIRT, M.D.,
CLEVELAND, OHIO.

I do not presume to present any radically new points regarding the usefulness of Phelps' operation, especially to this Association, as I feel that the members of this organization are well grounded in the elements of the treatment of club-foot; yet I do believe that I can present some experience which may be of use to the general practitioner and the surgeon, whom we know have widely different opinions on the subject of the treatment of this affection.

Even this Association is not united in declaring for any given method of treating club-foot. Our ex-President, Dr. Steele, in his address, last year, called attention to this by the remark, that "if one simple plan of treating club-foot was always successful there would not be such a variety of methods suggested." Let me further illustrate this diversity of opinion: In the Surgical Section of the Mississippi Valley Medical Association at their last meeting (October, 1893), a surgeon of some prominence presented for the consideration of the Section, and advocated strongly, his new operation for the cure of inveterate club-foot, which was a modified Chopart amputation. He claimed that in many of these cases he had failed to cure by all methods available, and further believed that this operation would give the best walking extremity obtainable.

This is certainly an extreme view. The opposite extreme opinion was presented, in the discussion which followed, by a gentleman holding the chair of general surgery in one of our Western colleges, who claimed that in his experience he had never seen a case requiring a cutting operation of any kind, but that he had deemed

mechanical force under an anæsthetic plus the use of braces all-sufficient.

I therefore feel that any experience which will tend to establish an operation between the above extremes, which shall be satisfactory to the general profession in a given class of cases, is reason enough for its being recited.

As to the question of a Chopart operation or any modification of it for the relief of club-foot, I stated then, as I hold to-day, namely, that any amputation of a part of the foot for the relief of this condition is a stigma to surgery. The operation is not deserving of much serious thought. In regard to the other extreme view, viz., that of attempting to cure all cases of club-foot by mechanical force (say tarsoclast) under an anæsthetic, I would say that I have had some unfortunate experience, which has led me to avoid in certain cases carrying it to that extreme which is necessary in order to correct the deformity by this method alone.

Case I.—Oliver F. M., ten years old, with double congenital equino-varus, dislocation of left hip and imperfect action at both shoulders (the latisimus dorsi of both sides being short); also creaking motion at knee-joints; boy somewhat anæmic, circulation not very vigorous. Operated for cure of deformity of hand and both feet. I cut both tendines Achillis subcutaneously and fascia of sole of feet; also astragalo-scaphoid ligament. Used the Thomas tarsoclast with considerable force, finally getting the feet into good position, as shown by my notes in case-book. I saw the patient two hours after the operation, when the circulation had returned to all toes except great toe of the left foot. I gave orders to house doctor that if the circulation did not return in a short time to cut down on the plaster dressing and relieve the tension. Two hours later (9 P.M.) I telephoned to the hospital, and was informed that the circulation had returned nicely to the great toe in question. I now think that this was an incorrect report carelessly made. At 8 o'clock the next morning I was called by telephone to come immediately to the hospital, as patient's foot was in a bad condition. I immediately went to see him and found the great toe of a dark-bluish color, the second toe in nearly the same condition, and on removing the plaster I found a bleb on the inside of the arch of the foot two inches in width and nearly four inches long. At the position of

this bleb sloughing subsequently took place. The lateral ligament of the great toe sloughed away, the tendon of the extensor proprius pollicis was exposed for about an inch, and also the bone at one or two points. The casting off of the slough and the suppurative process were very slow, keeping the boy confined to the house an extra month and a half. From the loss of the lateral ligament the toe was drawn out of position and an amputation of the toe was done. Ultimately I got a good result, the feet being perfectly straight, the boy walking very well. It is possible that had the plaster been removed the same evening of the operation the slough might not have taken place. Quite certain I am that had I followed the suggestion of our worthy President, with whom I discussed this case at our meeting in New York, and who advised the open incision, no such accident would have followed.

Case II. (About six months after operating on Case I.)—Emma W., aged forty-four years, came to me for treatment. She was a maiden lady of marked subnormal cerebration, under size, being only about four and one-half feet tall, weighing probably about ninety pounds. She was anæmic, being about as colorless as anyone I have ever seen. Her hands were delicate and no larger than those of a child eight or ten years old. She had right equinus and left equino-varus from infantile paralysis. Being rather an unpromising subject I did not urge an operation, but spoke rather discouragingly of the possible outcome. But she declared that she had made up her mind to have an operation, no matter what happened. I soon saw that she had a strong will if not backed by good judgment. Under an anæsthetic I cut the tendo Achillis of left foot subcutaneously, also the fascia of sole, then by the Thomas torsoclast wrenched the foot into good shape, carrying it over as far as I desired, then put it up in plaster. I will here remark that her foot was as pliable as that of a child six years old or younger, and was carried into a position of valgus by the tarsoclast without the use of extreme force. Having had the former unpleasant experience, and this being an unpromising case, I determined to watch the foot carefully myself. Soon the circulation seemed fairly good except in the great toe. In a little over an hour, finding that it still did not return in this toe, I cut through the plaster and sprung it apart. Two hours later, still finding imperfect circulation, I took

off the plaster entirely. Even then the circulation of the skin did not return over a large area on the inside of foot, toe, and heel. I am convinced that in this case the sloughing was due to the stretching of the skin pure and simple. This is proven by sloughing taking place on the heel where there was no pressure whatever either by tarsoclast or plaster-of-Paris. Had I done the open-incision operation in this case, as I certainly would do now, I feel reasonably sure that healing would have taken place in a month to six weeks instead of having to wait for the tedious healing of an extensive slough.

In contrast to the above-mentioned case, I desire to report Phelps' operation on a girl nearly nineteen years old.

Case III.—Addie P., aged nineteen years, of Lottsville, Pa. Double congenital equino-varus. When a few months old an operation was performed on both feet; she wore braces until the age of five years. Both feet were still badly deformed. She was then taken to Buffalo, and again had both feet operated upon without much improvement. At home, by the use of braces, massage, manual force, and plaster, the left foot was nearly cured, and there only remained at the time of my examination some shortening of tendo Achillis which permitted the foot to flex to just a right angle. The patient was satisfied with this foot, and only wished for correction of deformity of the other (right) foot. The right foot could not be flexed to less than 110°; there was marked cavus and varus of moderate severity. Under an anæsthetic I cut the tendo Achillis subcutaneously, and after some minutes' trial found that I could not get the heel down, so I made an open incision over the tendon, cutting as much of the posterior heel ligament as I could reach, inserting the blade of the knife over an inch below the level of the skin. Considerable hemorrhage followed the last deep cut, and for a time I thought I had severed the posterior tibial artery, but by packing the wound the hemorrhage was soon stopped, and from the lack at any time of interference in the circulation of the foot I was led to believe that it was the internal calcanean, which I think I have cut on several occasions. Having gotten the heel down satisfactorily I made the open incision from a point about an inch in front of the anterior part of the inner malleolus straight downward to about half across the sole of the foot; cut

through everything, including astragalo-scaphoid ligament. I then applied the wrench; but with all the power I could use was unable to get the foot into satisfactory position, so again applied the knife, cutting more ligamentous tissue. On a second application of the tarsoclast I was able to bring the foot into entirely satisfactory position; the wound gaped about an inch and was lightly packed with gauze and the foot fixed in plaster-of-Paris. Wound filled slowly but perfectly. She wore a brace about four months as a precaution, but I hardly think that it was necessary. May 18, 1894, I received a photograph and a letter saying that the foot is perfectly straight, that she wears the same sized shoe as on the other foot, that she can walk a long distance without tiring, and that there is no disposition for the foot to turn in. In other words, it is about as nearly a perfect result as one would wish, and this in a young lady nineteen years old.

Case IV.—Two years and a half ago I removed a wedge formed of parts of the os calcis and cuboid, after finding that I could not straighten by tenotomies and tarsoclasis in the case of a girl about twelve years old, upon whom six previous operations (tenotomies) had been performed by three different surgeons. I got a perfect result as far as position of the foot is concerned, and the girl walks without limp; but we have here, as after all operations where a wedge is removed, a foot somewhat smaller than the other one; and there is also some flat-foot existing. This is another case in which I would now make an open incision.

The question now arising in the discussion of this problem is, What are the possibilities of the open incision plus other more radical measures in adult club-feet? My belief in the matter is, viz., that by tenotomies, the open incision, the removal of a tarsal wedge, and the removal, sometimes, of the astragalus, the feet in the worst cases will be brought to the front; not that the feet in the severer forms found in adults will be perfect, but, though lacking much motion at the ankle, and the elasticity and form of the arch being gone, and perhaps somewhat misshapen, yet will they be so much superior to the condition in which we find them that the propriety of the above-described operation cannot be questioned.

To the assertion that Chopart's amputation is indicated, I venture to say that but few if any will assent; and I dare say that

none will claim that tenotomies with tarsoclasis will cure the worst cases.

CONCLUSIONS.—From my experience and observation I am led to draw the following conclusions: The skin in the case of some adults and older children will not stand the amount of stretching necessary to bring the foot into good position, but sloughing will take place. Therefore in these cases tenotomies and tarsoclasis will be unsatisfactory, though sufficient to correct the deformity.

Tenotomy of the tendo Achillis, and in some cases section of the heel ligaments, the open incision on the concave side of the foot, and the use of tarsoclasis will cure many of these adult club-feet. In the worst cases, in addition to the above, removal of a tarsal wedge or the removal of the astragalus, or both, may be required before the deformity can be overcome.

ELASTIC TRACTION IN THE TREATMENT OF INFANTILE CLUB-FOOT.

By BERNARD BARTOW, M.D.,
BUFFALO, N. Y.

Considering the many good purposes which are served by the use of elastic traction in the mechanical treatment of deformities, this agent has been given a place of unmerited obscurity in the treatment of congenital club-foot as compared with other, and often inferior, methods which are being constantly used. This comparison will hold good, especially in the application of elastic traction to the treatment of the resistant form of infantile talipes, when used in connection with tenotomy, for the replacement of the distorted foot. In the early months of infancy the rapidly increasing force of contraction in the muscles which control the malposition soon causes an appreciable addition to the degree of deformity which was present at birth.

So uniformly does this follow the neglect to restrain these muscles that the rule of treatment points very directly to the rectification of malposition at the earliest moment consistent with safety — safety in this connection implying the age when the administration of an anæsthetic will not be attended with unusual risk.

The subcutaneous section of tendons and other resisting tissues as early as the third week is not only sanctioned by many surgeons, but among a large number is actually the rule of practice when possible. All who operate early in these cases can appreciate the advantages that follow in the greater ease with which the deformity may be overcome and the shorter time required to re-establish the normal relations of the foot. Personally my preference has been to operate before the eighth week. I have operated, however, as early

as the third week, and frequently at the fourth week, and, other things being equal, prefer the earlier to the later period.

This has been termed "premature practice" by some surgeons; but this criticism, I think, is to be attributed more to the quality of care which the foot has received subsequent to tenotomy than to any inherent objection to releasing the foot from its constrained position at so early a period. Chief among the obstacles attending this plan of treatment in patients so young is the difficulty of applying retention dressings for securing the corrected position of the foot. The armamentarium of the surgeon in this connection consists principally of gypsum and adhesive-plaster dressings, or splints of some plastic material, which may be moulded upon the limb. Whatever form of retention dressing is employed, to be effective it must reach above the knee and be adjusted to the position of semi-flexion, to restrain the inward rotation of the limb, to prevent displacement of the dressing. Practically this places the entire limb under restraint below the hip-joint. Many muscles which would exert no deleterious action on the deformity, are held in a state of inactivity, in order that the especial distorting muscles may be controlled. This is not only detrimental to the muscular development of the limb, but its nutrition also suffers, both from restraint and constriction. Occasionally, too, there is liability to dangerous constriction of the limb, following its envelopment in a hard, resisting dressing. With the utmost care in its application, friction or pressure-irritation is liable to occur, which may give rise to swelling of the foot sufficient to induce strangulation if the dressing is not speedily loosened.

Partly for these reasons, and partly to secure the foot after operation in a dressing more convenient to apply and that better fulfils the indications of treatment than the gypsum or other dressings alluded to, I have employed elastic traction in the manner to be described, as a retention and at the same time an active correcting appliance. One of the strong recommendations for this plan over the gypsum bandage, *e. g.*, is that the foot is not maintained in a state of passive fixation during the time the dressing is worn.

It is not necessary to refer to the uses which have been made of this agent more than to mention that it has usually been sub-

ordinated to a brace of some character. The plan suggested by Mr. Barwell, which places the points of fixation for the traction immediately in contact with the limb, offers a more extensive and simple application of the principle; and it is to this idea that I am in a measure indebted for the plan which I have to offer. I am not aware of the extent of the application of elastic traction intended by Mr. Barwell. For the especial class of cases to which I have applied it the details of his method are too complicated for practical use; employed in connection with operative treatment it would not, I am satisfied, accomplish the desired object as easily or as perfectly as the modification proposed. In the use of elastic traction by the writer the attempt has not been to imitate the action of a particular muscle or group of muscles, but to supplement tenotomy by grasping the anterior part of the foot, and pulling it upward, abducting and twisting it, in much the same manner that may be done in the correction of the deformity by manual force. In short, to make the foot assume more nearly its normal relations to the limb and to control this position continuously by opposing elastic force to the muscular contractions which tend to re-establish deformity.

The plan of treatment which I have indicated is as follows: After the section of resisting tendons and fasciæ the foot is stretched by manual force until it can be placed in a position of mild calcaneo-valgus. A considerable degree of overcorrection is desirable if it can be obtained. The tenotome punctures are then carefully sealed with collodion and cotton. The overcorrection is secured by elastic bands attached to the adhesive-plaster bearing on the outer side of the foot at the base of the little toe; the other end of the elastic is fastened to a second adhesive-plaster attachment near the knee and at the outer margin of the patella. Elastic traction applied in this direction will flex and abduct the foot and elevate its outer margin; at the same time the upper point of fixation of the traction being so near the knee-joint, it will induce moderate flexion at the knee, which tends to rotate the limb outward.

This meets all the indications as regards the posture of the foot which are to be secured by any appliance. Coincidently no restraint is placed upon muscles other than those which directly

induce malposition. With this exception, the limb is quite free to assume any position, and it is also permitted a variety of active movements such as the infant is capable of executing. The foot-piece for attaching the elastic is placed anteriorly to the medio-tarsal articulation; it should include all of the foot between that joint and the base of the toes. It is made of one-half-inch strips of the best rubber adhesive plaster, laid so as to partly overlap one another, extending from the outer margin of the foot to the dorsum, around the inner margin, across the sole, and converging slightly at the base of the small toe, the ends being left to extend about one inch beyond the outer margin of the foot, to make a fastening for the elastic. Two or three layers of plaster are laid, one over another, in this manner, to give the dressing firmness. The projecting end is trimmed to a tapering shape, and a small piece of plaster is laid face on to the adhesive surface, so that it will not stick to the girdle at the point of beginning, and constrict the foot. A dress-hook or a small safety-pin is fastened to this tag for the attachment of the rubber bands. The stiffness of the foot-piece and its better security against slipping are aided by placing a foot-plate between the layers of plaster. This may be made of thin zinc, block tin, or gutta-percha, shaped to catch around the great-toe joint and reach across the sole; it may even project slightly beyond the outer margin of the foot, to give greater leverage to the traction. The traction end of the foot-piece should be guyed by narrow bands of plaster to the body of the dressing after the elastic is attached. This prevents its slipping backward toward the centre of the foot, which would diminish its flexing and abducting force.

The upper point of fixation for the elastic band is made of a split fan-shaped piece of the same plaster, the ends of which are spread out upon the anterior and lateral parts of the thigh, some of them reaching as high as the iliac crest and on to the buttock. The tapered end of the fan-piece should reach just below the knee-joint, and lie closely to the outer margin of the patella; if this is placed too much on the side of the leg the traction will not sufficiently evert and twist the foot. Additional narrow strips of plaster may be placed on the thigh, extending obliquely, and meeting with the point of the fan, reinforcing it and giving it greater security. A dress-hook or small safety-pin is also fastened to this part. No

bandaging will be required to prevent the plaster slipping if a good quality of plaster is selected. A number of common rubber bands (No. 12) are looped over the hooks, forming the traction power. Two or three of these will usually be enough to hold the foot in the corrected position soon after the tenotomy and stretching have been made; as the traction is continuous, care must be used to keep it within limits that will not be painful. During the first twenty-four or forty-eight hours after the operation the traction need not be stronger than will suffice to hold the foot in a state of moderate correction. After that time it may be considerably increased without causing much discomfort. As time goes on the traction can be exerted with as much force as the plasters will sustain without slipping, and, usually, this is more than is ordinarily required. When desirable, the attachment of a few additional elastic bands will give the required increase of power. The elastic traction in an increased or modified form, as the case may demand, should be continued until the unaided muscles will retain the foot in the desired position.

The traction attachments can conveniently be arranged on the limb and foot previously to performing tenotomy, everything being then in readiness to secure the foot in a corrected position. This dressing admits of easy access to the foot for manual stretching, and at the end of one week this practice is systematically begun. In fact, manual stretching becomes an important feature of this plan of treatment from the beginning to the end. In every instance the parent or nurse is carefully instructed in the performance of these movements, and is directed to apply them two or three times daily. The value of this procedure cannot be overestimated for giving permanency of correction to the foot. In addition to the greater mobility of the foot which it develops it undoubtedly stimulates the nutrition of its tissues—in effect not unlike what follows from the weight being borne upon it.

The varus element in the deformity, which is usually difficult of management under any plan of treatment, yields with greater readiness by this combined method than by any other course that I have pursued. In no instance has it been necessary to resort to any other appliance for its relief. In fact, I have quite ceased to have any use for the surgical instrument-maker in the treatment of this

class of cases—a good shoemaker being about the only accessory in the case.

This plan of treatment will be found generally applicable and reliable for the entire care of the foot until the balance of muscular action is adjusted so that the foot will naturally assume its functional relations. Employed in the earlier months of infancy the foot is held in a position which will permit of its normal use by the time that the child has reached the age when he should begin to walk. The traction dressing can be easily applied on the youngest patient, and once in place the infant cannot displace it. Its simplicity makes it additionally valuable by permitting of its readjustment by the parent or nurse in an emergency, or when the case is too far removed from the surgeon to admit of frequent oversight. In some of the best results which I have secured there has been a large amount of home treatment of this kind. This prevents lapses in the employment of the traction, which would be favorable to the recurrence of deformity, while the uniformly steady use of correcting force is especially advantageous in hastening final recovery.

The development of the limb which this plan of treatment permits coincidently with the control of the foot is by no means of minor importance. When the extremity is held passively in a rigid dressing or apparatus for a number of months, often reaching well into the age when the child should walk, there has been but little opportunity to prepare it for the exercise of this function. Disuse of muscles and continuous joint-fixation leading to atrophy are not conducive to the rapid acquirement of the power of locomotion. I have observed a marked difference in these particulars in the cases treated by elastic traction as compared with those patients who had been treated by the gypsum bandage. In the former class the limbs have shown greater vigor and a better position of the foot for use at the usual age for walking.

The only objectionable feature which this dressing presents is its exposure to soiling by the excreta of the child. The same difficulty, however, attaches to any appliance which is placed upon the limb of an infant. It rarely happens that the dressing must be changed oftener than once a week, and with a little additional care it will hold securely for two and sometimes three weeks.

A small sock may be drawn over the dressing after it has been completed, which will assist in preserving cleanliness without interfering with its efficiency.

The slipping of the plaster does not cause serious interference with the treatment; a little sliding of the plaster is compensated by the elasticity of the rubber, so that only a slight diminution of the traction follows. If too great an amount of force is not exerted, but little annoyance will be experienced from this source. I have never been obliged to discontinue the traction because of irritation of the skin; in some cases it has been applied repeatedly for months without causing disturbance. This has been a matter of surprise to me, as I had fully expected that this would be one of the chief obstacles to the employment of the dressing. The only explanation that I can give of this is that the limb is not bandaged after the application of the plaster dressing.

To summarize briefly: Elastic traction used in connection with tenotomy and manual stretching fulfils the indications as regards the position in which the foot is to be held during treatment. The force, applied in the manner suggested, is constantly acting to overcome deformity.

It allows of inspection and frequent manipulation of the foot.

Free movement of the limb and limited movement of the foot are permitted without favoring the recurrence of malposition.

The development of the limb during the period of treatment is not retarded.

Constriction of the limb is avoided.

Displacement of the dressing cannot easily occur.

The dressing is light and especially adapted to very young patients.

The plan of treatment suggested will generally suffice for the correction of the deformity.

DISCUSSION.

Dr. Newton M. Shaffer, of New York, said that the question suggested itself to him as to the comparative value of intermittent traction and continuous traction. Both were of value, and

elastic traction when applied to certain conditions of club-foot, particularly when in infants, was a very valuable procedure. From the description of the method of traction he would think it superior to others previously described. He now called this method "re-traction." In young children the result was very rapidly obtained. He would especially call attention to the statements made by the author, that the nutrition was markedly increased as a result of traction of any kind. The great improvement following intermittent traction was something surprising. It did not cause atrophy, but just the reverse. He had seen the calf muscles increase one inch under a few months of the traction treatment, and he had even had cases of infantile paralysis come to his office in cold weather, because after a few moments' traction the feet would remain warm for the rest of the day.

Dr. L. A. Weigel said that the term "cure" was often improperly applied to cases of club-foot. He reported a case of double club-foot and double club-hand in connection with this discussion. The points of special interest were the position of the feet and the extreme degree of deformity. This was well shown in the casts presented. At the age of one year the boy had been treated in the Birmingham Hospital in England by tenotomy. Nothing further had been done till he saw the child last year. There was then extreme equino-varus with double club-hand, cross-legs, and a displacement of the tibia; or, in other words, rotation of the tibia and displacement of the knee-joint. Through the open incision all the parts were divided, including the bone, and then by manual force he attempted to correct the deformity, but in so doing accidentally produced a compound dislocation of the ankle-joint. The part was sewed up and healed without suppuration, and the foot was greatly improved in appearance. The deformity of the toes was, of course, overcome by the operation. The varus was overcome, but not so the equinus, owing to the great alteration in the bones. At a later period cuneiform section was made of the tibia just above the malleoli, so as to bring the foot up. The result was fairly good. On the opposite foot a comparative test of the method was made. The tendo Achillis was divided and simply the astragalus removed. This gave a much better result as regards the

varus than by the Phelps operation. Subsequently an incision was made across the foot and a wedge taken out of the foot, and the wound closed by suture. The foot was now useful, although not ornamental. There was good plantar impact. In the right foot the result was not so good, owing to the impossibility of correcting the equinus. The boy was fifteen or sixteen years of age, and had made no attempt at walking until a few months ago. Now, with the aid of crutches, he was able to stand, and probably in the course of time he would be able to get around fairly well. This case simply emphasized the fact that every case should be a law unto itself.

In answer to a question from Dr. Ketch, he said there was no evidence of any spastic element in the case.

In another case, that of a girl of twelve years, he had tested the comparative merits of the operations. In one foot he did Phelps' operation, and in the other he removed the astragalus. The latter gave a much better result. The Phelps operation did not seem to him to be applicable to these extreme cases. The trouble with the Phelps operation was that it was almost impossible to secure a complete correction of the varus.

He had understood Dr. Wirt to say that he made an open incision of the tendo Achillis. This seemed to him wrong; if subcutaneous section were not sufficient to overcome this resistance, he did not see what was to be gained by an open incision at this point. Whatever parts required division could be better reached by an incision of the soft parts on the inner border of the foot.

Dr. W. R. Townsend said it looked as if these discussions would run on indefinitely, and each would be of the same opinion still. In justice to Dr. Phelps, he would say that Phelps had never claimed that division of the soft parts would rectify bony deformity. The secret of Phelps' success in these severe cases was not in the open incision, but in the amount of force he applied, a force which had been calculated to be equal to a thousand or more pounds. It was applied by means of his long-handled and power osteoclast. The Phelps operation was indicated, it seemed to him, in less cases than one would imagine in reading the literature. It was useful where there was retraction of the soft parts, but in most cases in which it was resorted to the deformity could be corrected

by Shaffer's apparatus or by manual force after tenotomy. In a severe case like that just described, the incision would be on the wrong side of the foot. The idea of doing a cuneiform osteotomy after a Phelps operation was absurd; no one, he thought, would care to make more than one such attempt. The astragalus was the keynote of the situation in most cases. It seemed to him that the limitation of Phelps' operation was greater than had been supposed. Where there was retraction of the soft parts and extreme bony deformity it was bound to fail, and it was not indicated in the very mild cases; hence, although an excellent operation, it had a very limited field of usefulness. It was the after-pulling and correction which were all-important.

Dr. Ketch said that the case presented by Dr. Weigel was interesting in many respects. The whole picture suggested to his mind was one of spastic paralysis, notwithstanding that the history would indicate that it was congenital. He had only seen three or four cases of club-hand, and he had never seen the peculiar position of wrist-drop. Some of the deformities were almost typical of a paraplegic case.

In connection with the Phelps operation on cases of this sort he would say that he had seen quite a number of cases operated upon by the open incision, and with very much the same result as that described by Dr. Weigel. In cases where the proportion of bony distortion exceeded the contraction of the soft parts, the operation was not a success.

Dr. W. H. Hingston, of Montreal, was invited to participate in the discussion. He said we should not be wedded to any one kind of operation. In France, when you want to have your hair dressed, the *artiste* would tell you how it was to be cut, but he would then hand you over to another to do the work. It had occurred to him that, in the consideration of club-foot, those who were too warm advocates of either the open or Phelps method, or the operation on the bones, would fall into error. There were cases which would be benefited by the open incision, and others which would not be benefited by this procedure. He had practised this open division quite frequently, sometimes with success, and sometimes with disap-

pointment. His first cases were apparently more successful than the later ones, perhaps because he had not chosen his cases properly. There was no rule to guide us; each case had its individuality, and the good common sense of the surgeon must decide which particular method was most suitable in each case.

Dr. Coolidge, on behalf of Dr. Halsted Myers, of New York City, described a new method which the latter had devised for use in these cases. With reference to the severe cases of club-foot, where it was necessary for one of the bones of the foot to be removed, instead of making a large incision for exsection of the bone, he advised making a small incision over the bone itself, not more than three-fourths of an inch in length; then, as the bone on the inside was made of spongy tissue, a sharp Volkmann's spoon was inserted, and all of the internal structure of the bone scooped out. Then, with comparatively little force, with an instrument or with the hands, the foot could be brought around into as good a position as though the bone had been completely exsected.

Dr. Weigel then presented additional plaster impressions of the feet, showing the functional and cosmetic results of the two operations. He fully agreed with Dr. Townsend as to the limitations of the Phelps operation.

Dr. Wirt did not understand that Phelps claimed that his operation would cure these severe cases. A combination of the two operations in very bad cases would be likely to give better results. In the use of the great force to which Dr. Townsend had alluded as being the secret of Dr. Phelps' success, it was quite possible to tear the soft tissues of the foot, or even to produce sloughing.

Dr. Townsend said he thought he had been misunderstood. If we would apply the same force in a given case without the Phelps operation we would tear the foot. He simply had endeavored to make the point that after the open incision the force was applied, and with the open incision no such accident would occur. The open incision, however, must always be made before the application of this great force. He had seen a number of relapses after Phelps' operation, and Dr. Phelps had told him that they were due to the neglect to properly stretch the parts immediately after the operation.

THE ANTERIOR TRANSVERSE ARCH OF THE FOOT: ITS OBLITERATION AS A CAUSE OF METATARSALGIA.

By JOEL E. GOLDTHWAIT, M.D.,
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By far the most important feature of the human foot, when considered from a mechanical point of view, is the arrangement of the bones of the tarsus and metatarsus into arches, upon which the weight of the body is borne in standing or walking. These arches are arranged longitudinally and transversely, and the proper maintenance of both is important.

The longitudinal or antero-posterior arch is the larger and the more important. Anatomically it is thoroughly understood, its pathological conditions are well recognized, and the methods of treatment are well defined.

The transverse arch is smaller, less noticeable, of much less importance in the large majority of cases. Anatomically it is recognized; but its pathological conditions have not been considered. It is most noticeable at the tarsus, where it is formed by the cuboid, scaphoid and the three cuneiform bones, but extends forward as far as the metatarso-phalangeal articulations, where, although much less clearly defined, it truly exists. Its presence at this point, a fact which has been denied by some authorities, has been proved to the satisfaction of the writer by the careful study of frozen sections of feet, and of impressions of the feet taken while supporting different degrees of the weight of the body. In the tarsus it is quite rigid, and is obliterated only as the longitudinal arch is obliterated, both being supported at this point by practically the same structures. In the anterior portion of the foot or at the metatarso-phalangeal articulations, it is less marked, and is present only when the foot is at rest or supporting comparatively little weight.

When the foot is first placed upon the floor, the heel and the outer and inner portions of the ball form the points of contact. In this position the heads of the second and third metatarsal bones are in a plane distinctly above the others, and no weight is borne directly upon them. As more weight is added the ball of the foot is gradually widened, and the heads of the second and third metatarsal bones are lowered; these, together with the first metatarsal, forming the chief support when all of the weight of the body is thrown upon the foot. At the same time the foot rolls outward, partly owing to a yielding of the antero-posterior arch, which causes a slight lengthening of the foot, and partly owing to the way in which the weight is received upon an arch that is poorly supported on the inner side. In this way the inner side of the foot is brought nearer the floor, and the centre of bearing is moved toward the inner side, thus relieving the outer side from much pressure. When the foot is raised or the weight is taken off, the reverse takes place; the foot shortens, owing to the re-forming of the longitudinal arch; the second and third metatarsal bones are raised—or the anterior transverse arch is re-formed; and the heel and the outer and inner portions of the ball of the foot form the last points of contact. From this it is seen that in walking the relations of the structures of the feet are constantly changing; the anterior transverse arch is continually being obliterated and re-formed, the longitudinal arch is alternately lower and higher, while the ligaments which are involved are constantly stretched and relaxed, and the muscles are in the state of alternate rest and contraction.

The anterior transverse arch is formed by the heads of the metatarsal bones; the first and the fourth and fifth (which act together) furnishing the base, while the second and third are raised above this plane, forming, as seen upon cross-section, a low arch. This relation is maintained by the transverse ligament, the transversalis pedis muscle, and the tendons of the peroneous longus and the tibialis posticus muscles. The plantar fascia, which is reinforced in its anterior expansion by transverse fibres, and the tendon of the flexor longus digitorum muscle—from its insertion and its oblique course across the sole of the foot—undoubtedly also exert some influence.

After studying a considerable number of cases in which the symptoms were referred to the feet, and after experimenting with

various lines of treatment, the author is convinced that the obliteration of this transverse arch is the direct cause of many of the symptoms, and that its restoration in these cases is of the same importance as is that of the longitudinal arch in the ordinary cases of valgus. With its obliteration, the weight is received directly upon the middle of the foot, the outer and inner sides no longer furnishing their normal support, so that nearly all of the impact comes upon the second and third metatarsal bones.

It is evident from the study of a large number of impressions of the feet that the obliteration of this transverse arch is very common —much more common than the flattening of the longitudinal arch— and that comparatively few persons suffer any inconvenience from it.

In a limited number of cases, however, this condition, usually so simple and of so little importance, becomes more serious, and symptoms develop which at times are most distressing and render treatment necessary. The two symptoms which are most common and which are present to a greater or less degree in almost all of these cases are irregular attacks of pain, referred to the anterior portion of the foot, and the presence of a painful callus in the middle of

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

the ball. The pain, which at times is constant and at other times paroxysmal (similar to that which has been described as anterior metatarsalgia) is usually referred to the centre of the foot, near the head of the third metatarsal bone. The location of the pain in the interspace between the fourth and fifth metatarsal bones—that which is described by Morton as being the common one—is certainly unusual, and the cases are strikingly few when compared with those in which the pain is referred to the middle of the foot. The callus, which may vary considerably in size, is formed directly under the

heads of the second and third metatarsal bones, as the result of the undue pressure at this point, and at times is so painful as to render locomotion difficult.

Besides these two symptoms, which are such constant ones and of so much importance as diagnostic signs, the diagnosis can be confirmed, in the majority of cases, by impressions of the feet, as with the ordinary cases of flat-foot. In the normal foot there is a sharp re-entering angle where the impression of the ball of the foot joins that made by the outer side, as is shown in Figs. 1 and 2. Both represent normal feet: Fig. 1, a foot of the long, slender type; Fig. 2, the other extreme. When the transverse arch is lost the impression presents an entirely diffrrent appearance, as is shown in Figs. 3 and 4. In place of the re-entering angle the tracing bulges at that point. In both of these cases the longitudinal arch is still present.

While it is possible to obtain an impression that is characteristic when the anterior arch is obliterated, this characteristic outline is

Fig. 5. Fig. 6.

lost if, at the same time, the longitudinal arch is destroyed. After some experimenting it was found that in the cases where the valgus deformity was not rigid, the impressions to determine the condition of the anterior arch could be taken with the same degree of accuracy as when the longitudinal arch was present, by simply varying the amount of weight supported upon the foot. The anterior arch, when obliterated, does not re-form, so that even the lightest pressure will develop almost as characteristic an impression as when the foot is firmly placed upon the floor. With the longitudinal arch this is not so. When the foot is at rest (unless the valgus is of the rigid type),

the arch appears very much as normal: but as soon as pressure is put upon it, it gives way. Figs. 5 and 6 are impressions of the same foot, taken at the same visit. The first was taken with the foot supporting all of the weight of the body, both arches giving way; while, in the second, the weight supported was very much less. In the latter instance the longitudinal arch remains, while the flattening of the transverse arch is clearly shown. The abduction of the foot which is present in the ordinary cases of flat-foot, does not, of course, occur when only the anterior arch gives way. This is also shown in Figs. 5 and 6, and is of importance in diagnosis.

The causes of flattening of the anterior transverse arch are much the same as recognized causes of flattening of the longitudinal arch: excessive standing or walking; injury, such as a sprain, or a fall in which the weight is received upon the front part of the foot; weakness following long sickness; and very probably improper shoes, chiefly those which are much too narrow.

The treatment of this condition naturally consists in the restoration of the parts to their normal relation—the re-formation of the arch. In some instances this has been accomplished by simply bandaging the foot tightly, a method which prevents the foot from widening when weight is borne upon it, and consequently the arch from lowering. In other cases it has been done by the use of felt pads, or leather inner soles so padded as to bring pressure just behind the heads of the second and third metartarsal bones. A metal plate has also been used in some cases, carried forward and raised to cause pressure, as with the inner soles. Pressure coming directly under the heads of the bones is, of course, to be avoided, as it would increase the sensitiveness of the callus. In connection with this mechanical treatment, exercises, massage and stimulating bathing are of value.

Conclusions.—At the metatarso-phalangeal articulations there is an arch, called by the writer the anterior-transverse arch. This, at times, becomes flattened, and symptoms develop which are characteristic.

The symptoms most commonly met with are pain, referred to the anterior portion of the foot—the so-called and anterior metatar-

salgia—and the presence of a painful callus in the centre of the ball of the foot.

The impression of the foot is typical, and can be developed in many cases, even when the longitudinal arch also is obliterated.

The treatment consists in the restoration of the arch by plates, pads, or bandaging.

TREATMENT OF CONGENITAL DISLOCATION OF THE HIP.

By E. H. BRADFORD, M.D.,
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The methods of treatment of congenital dislocation of the hip are:

1. By apparatus.
2. By forcible reduction without traction.
3. By operative reduction.

The treatment by apparatus, consisting of the application of corsets pressing upon the trochanters, to check the increase of the sinking of the pelvis between the hips and the lordosis, is certainly palliative rather than curative. The same may be said of treatment by traction appliances and ischiatic supports.

The treatment by traction recommended by Guérin, Pravaz, and more recently in a much more complete form by Buckminster Brown, cannot be regarded as reliable or generally practicable.

The methods of treatment by operation which have been suggested are numerous; that of reduction after subcutaneous tenotomy of the muscles would, in view of what is shown by dissection and pathological specimens, appear inadequate.

Treatment by excision practised by Rose, Huester, and Margary, hardly recommends itself as justifiable, unless in painful or helpless cases, and even in these in double congenital dislocation it would seem of doubtful advantage.

The cases where the methods of forcible reduction under anæsthesia would be successful are certainly few. The method has been tried by Post, of Boston, and by Paci, who reports success in some instances, but such cases must be of the lightest variety.

The method, which at present is attracting especial attention, is

that advocated by Hoffa, of Würzburg—namely, operative reduction of the congenital dislocation.

Hoffa himself has operated in twenty-four cases, and claims satisfactory results in most cases. His final conclusions he promises to publish later. He operates by preference on young children.

Mollière[1] reports two successful cases.

Denucé, of Bordeaux, reports a case of a child of six operated on by him. The left trochanter major was three centimetres above the Nélaton line, and after operation the head of the trochanter was not above the Nélaton line. A year afterward the patient was in good condition. There was no lordosis and little scoliosis. The difference in the length of the leg was about two centimetres, having been about five centimetres before.

Kirmisson,[2] in an excellent article on the subject, reports seven cases of the operation, with two deaths, and five satisfactory results. Of these five, three of the results are reported to be excellent.

Broca reported a death from this operation.

Lorenz, who has operated in a number of cases, mentions a case of septicæmia, and Kirmisson knows of a few fatal cases in the hands of other surgeons, which he is not authorized to mention.

Hoffa himself has had one death.

The method of operation is described by Hoffa in his work on *Orthopedic Surgery*, page 532 :

"After opening the joint by means of a Langenbeck incision, and subperitoneal separation of all the soft parts from the trochanter major, it is possible, in young patients to the age of seven, to place the head of the femur, by a flexion of the thigh and direct pressure, into the normal acetabulum. Without separation of the soft parts, even after the joint is opened, it is impossible to effect a reduction, but after the reduction of the head with the knee and hip flexed, if an attempt is made to straighten the knee, the head of the femur slips out of the acetabulum. It is, therefore, important that the head should be kept fast in the acetabulum, while an assistant gradually stretches the biceps, the semi-membranosus and the semitendinosus."

Hoffa also advises the subcutaneous division of the fascia lata,

[1] Lyon Médical, 1887, No.9.

[2] Revue d'Orthopédie, 1894, p. 186.

and the muscles which pass from the spine of the ilium. The second step of Hoffa's operation is the making of a new acetabulum. This is done by means of a Volkmann's curette, made in the shape of a bayonet, which, under the guidance of the forefinger, chisels out the whole of the acetabulum. Care should be given that the borders of the acetabulum remain strong. Hoffa claims that in a normal infant child's pelvis the ilium is thickest at the point where the acetabulum should be made deeper in a congenital dislocation. The third step of the operation consists of the reposition, which is recognized by the characteristic sudden motion of the head of the femur, as in reduction after traumatic luxation.

Hoffa claims that the obstacle to reduction is the shortening of the soft parts which surround the dislocated hip. This view is disputed by Karewski, who thinks that the altered shape of the bone interferes with the reduction, and by Lorenz, who thinks that the shortened adductors also prevent reduction.

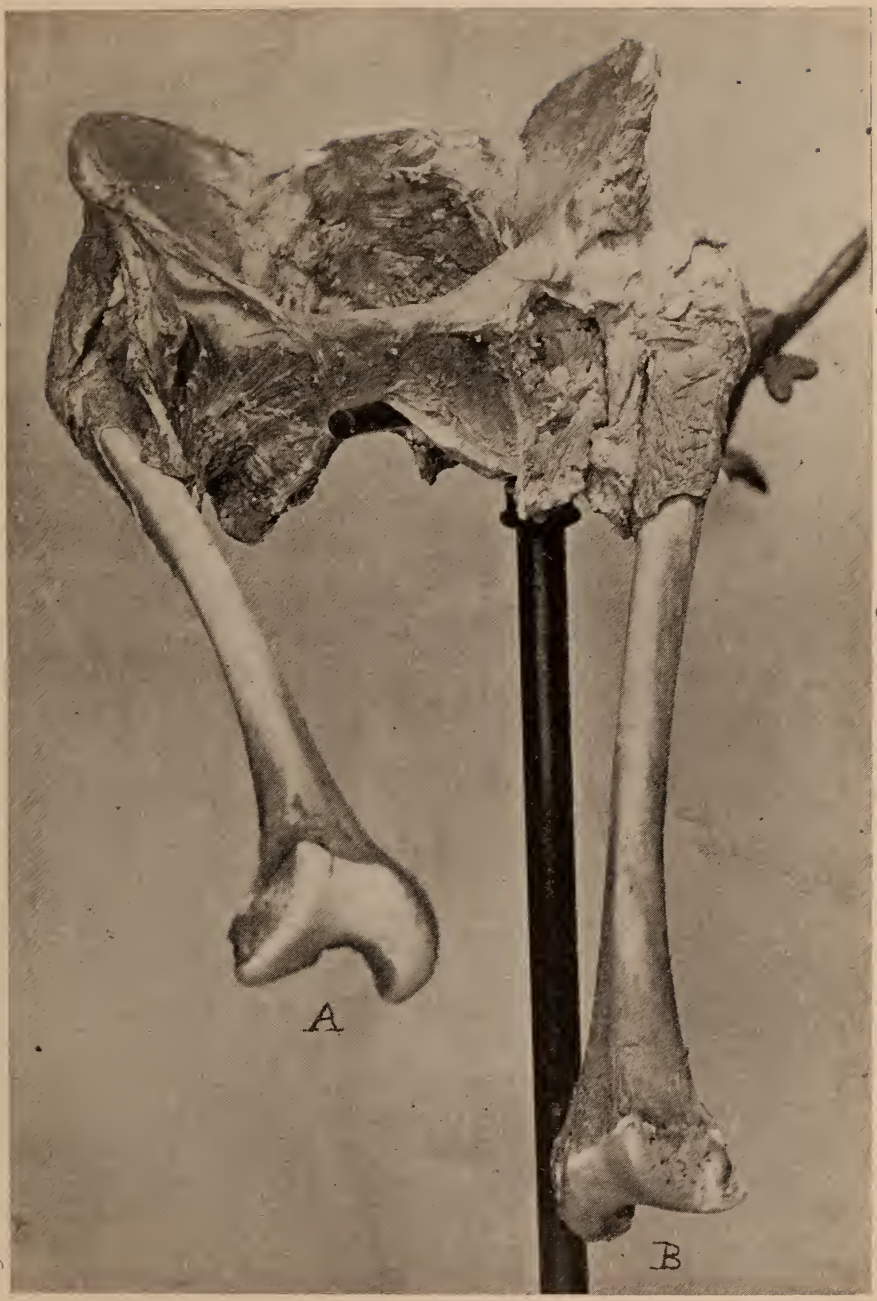
The obstacles to reduction and the difficulties to be met in operation are well illustrated by a specimen represented in the accompanying illustration. (Fig. 1.)

The specimen is from a child nine years of age, somewhat older than is most suitable for the operation, who died from diphtheria and septicæmia a month after Hoffa's operation. The wound had nearly united a week after the operation, the child's temperature, however, was elevated, and a diphtheritic membrane appeared in the throat; the wound afterward became septic, and at the autopsy evidences of extensive diphtheria and of septicæmia were found. An abscess near the hip had formed, passing from the inner side of the pelvis running upward in the sheath of the iliac muscle.

During the operation, which was conducted with the usual care, according to the steps mentioned by Hoffa, it was impossible to draw the head down as far the Nélaton line. The finger was inserted, and a point found where the acetabulum should be as far as could be determined by touch, and this was curetted and drilled out, forming, as was thought, an acetabulum of sufficient depth. It was impossible by any form of traction to bring the trochanter lower than was done.

Although all the muscles had been divided and removed, it was impossible to pull the femur into its normal position. Reduction

FIG. 1.



Anterior view of a specimen of double congenital dislocation of the hip after removal of superficial soft parts. A, femur not operated upon; B, operated upon, with improvement in position, but still not in normal position.

was possible by manipulation—*i. e.*, flexion and rotation; but dislocation occurred if an attempt was made to straighten the femur from the flexed position which it takes if the head is put into the acetabulum. The specimen shows that the obstacle is clearly the anterior and strongest fibres of the capsular ligament. On the side not operated upon it is impossible to reduce the dislocation by any method, either by traction or manipulation. The specimen also shows that although the curette was used at a point which at operation appeared to be the proper position, yet it did not enlarge the normal acetabulum, but was at a considerable distance above this place. (Fig. 2.)

It would also appear that Kirmisson is correct in claiming that facts do not support Hoffa's belief that the portion of the ilium in congenital dislocation that it is desirable to curette for the deepened acetabulum, is the thickest portion of the ilium. This was not found to be the case in any of the four specimens at the Warren Museum in Boston.

The clinical experience which the writer has had personally in the treatment of this deformity may be stated briefly as follows:

One case. Aged six years. Treatment by mechanical means—viz., the use of an ambulatory-traction applicance which was worn for two years, showed no change in the deformity.

One case. Aged three years. Treatment by an attempt at forcible reduction under ether, without success.

Three cases. Treatment by recumbency and traction for a long period.

Case I.—Aged five years. Treatment by recumbency for a year with traction. Afterward by traction appliances and crutches for two years, and subsequently by a corset pressing upon the trochanters. An increase in the deformity occurred in this case. The patient at present walks badly. The deformity was double.

Case II.—A child eight years of age was treated for six months by recumbency and traction. Afterward for four years by a leather corset (stiffened with steel) pressing upon the trochanters. The patient's figure has improved. No increase in the deformity occurred in the five years during which she was under observation, and at the present time the patient walks quite well, with but little waddling in gait. The deformity was double and

Fig. 2.

View of innominate bone and head of femur from a case of congenital dislocation of the hip, after operation for formation of new acetabulum and reduction of the dislocation.

the patient strong. The patient is at present sixteen years of age.

Case III. (double) was treated for three years by recumbency, the treatment beginning when the child was three years of age. The case is reported[1] elsewhere, with details of apparatus. Subsequent treatment was by ischiatic crutches, which were worn for two years, and at present a leather corset pressing upon the trochanters is worn. There has been a reduction in the deformity, the trochanters standing lower than before treatment was begun. The patient walks well and the trochanters remain fixed and cannot be pushed up or down, but they remain an inch higher than the Nélaton line, though formerly an inch and a half.

Five operations according to Hoffa's method:

A. F., three years old. Double deformity. Two operations.

A. W., three years old. Single deformity. One operation.

M. C., three years old. Single deformity. One operation.

M. Col., three years old. Double deformity. Two operations.

H. K., eight years old. Double deformity. One operation.

The results in these cases can hardly be considered satisfactory. In all except the last the wound healed up thoroughly and well. In the last the wound, a week after operation, was progressing favorably, but the child was seized with diphtheria and died three weeks later with diphtheria and sepsis of the wound, being the case the specimen from which is presented in this paper.

In the case of M. Col., the first operation healed readily, but a week after the second operation the patient was taken with scarlet fever and died.

In the case of A. W., the wound healed, but the child died with symptoms of diarrhœa and vomiting, a month after operation, apparently without any connection with the operation, the wound having entirely healed.

In the surviving cases, A. F. and M. C., the patients recovered well from the operations (double in the first and single in the second case). It did not appear, however, that the head of the femur was well fixed in the new acetabulum in either of the cases, or that the patient had been materially benefited by the operation.

[1] Transactions of the American Orthopedic Association, vol. iv. p. 308.

The three deaths can hardly be attributed fairly to the operation, the first two occurring at a time when the hospital was visited by an epidemic of contagious disease. It is probable, however, that the operation may have diminished the patient's power of resistance, in both these cases as in the third case.

The obstacles which the writer has met in Hoffa's operation are: first, the difficulty of exactly determining the location of the true acetabulum; second, the difficulty of complete reduction; and, third, the difficulty in retention of the head when thoroughly reduced. The first of these difficulties can, in a measure, be met by an increased experience with the operation. The second of these obstacles is overcome by Hoffa, not only by the serverance of the muscles from the head of the trochanter, but also by a complete freeing of the capsule from the neck of the femur. This is accomplished after opening the capsule from behind and thrusting the femur upward through the wound and freeing the capsule from behind forward.

Hoffa finds his best success in younger children, and is unable to effect a reduction in children of advanced age in adolescence.

Lorenz advocates an anterior incision.

In view of the evidence given in pathological specimens here reported, it seems clear to the writer that the chief obstacle to the reduction lies in the ilio-femoral bands of the capsular ligament (the so-called Y-ligament of Bigelow), and that for a thorough division of these fibres it is better to open the capsule from the front—than from behind—as the strongest bands are on the anterior surface.

Through the courtesy of Professor Dwight, and with the assistance of Dr. Prescott, a number of dissections of the hip-joint were examined, which displayed the attachments of the capsular ligaments of the hip, seen in their anterior and posterior aspects. Operative procedures were tried upon cadavera, and the following lines of incision were found to be of advantage: A long incision is made on the outer side of the thigh, reaching from one inch above the trochanter to two inches below. The incision penetrated to the head of the femur, the neck, and along the outer border of the trochanter. The incision is slightly in front of the external border

of the trochanter. The soft parts are retracted, and the attachment of the muscles to the head of the great trochanter separated, the anterior aspect of the neck of the femur and the adjacent trochanter freed, and the soft tissues retracted so as to lay bare the neck of the femur on its anterior aspect, and an incision at right angles with the axis of the neck freely made, thoroughly dividing the attachments of the Y ligament near the inter-trochanteric line of the femur. After this is divided it will be found that after the cotyloid ligament is incised the head of the femur can readily be pulled down an inch; in congenital dislocation, where the cotyloid ligament is not present, no difficulty will be met in placing the head where it is desired after division of the contracted soft parts. The operation would, therefore, consist in making, under aseptic precautions, a compound dislocation of the head of the femur, removing it from its abnormal socket and placing it in the normal socket, dividing all tissues which prevent reduction.

The incision here mentioned would seem to have the advantage over the method described by Hoffa in dividing more directly the most resistant checks to reduction. It is probable that, in the successful cases which Hoffa reports, the attachments of the capsular ligament have been thoroughly freed, but it would seem to the writer that this would be accomplished with certainty, in the incision recommended, only by a surgeon of Professor Hoffa's skill and experience in the operation.

It has occurred also to the writer that in all probability if an anterior division of the strong ilio-femoral capsular bands were to be made freely, older cases would be operated upon with better success than those of the age recommended by Hoffa, for no direct obstacle exists to reduction even in adolescent cases except the contraction of the soft parts.

The incision which seems to the writer most suitable may be briefly described as a primary side incision along the trochanter (in front of the line of the Langenbeck incision) and a secondary deeper cross-cut on the anterior surface of the capsule near the inter-trochanter line of the femur.

Instead of this incision the Lorenz incision, *i. e.*, an anterior incision directly over the neck and exposing at once the anterior face of the capsule, naturally suggests itself. This has its advan-

tage, but the attachments of the muscles to the greater trochanter are not so readily freed as by the side incision, and drainage is not so well provided for, which in a deep wound is of importance.

Since the experiments were made upon cadaver the writer has had an opportunity of performing the operation on a living subject, a child four years of age, with a congenital dislocation of the hip on the right side, the result confirming the conclusions reached by anatomical investigations. The operation was done in the manner just mentioned, and reduction was made readily, the head of the femur slipping without difficulty into the acetabulum. It was found, after the attachment of the muscles to the trochanter had been divided, that on flexion of the limb reduction by manipulation was readily made, but on attempting to straighten the limb the head of the femur slipped instantly from the normal acetabulum. After, however, the anterior bands of the capsular ligament were freely divided, the head remained in its socket without difficulty in whatever position the limb was placed without the use of traction. Some contraction of the adductor muscles was found on extreme abduction of the leg. The most resistant fibres of the adductor magnus were divided by open incision. The patient has recovered from the operation, the wound has healed, but, as only six weeks have elapsed since operation, the ultimate result cannot be reported as yet. The case can, however, stand as evidence of the readier method of successful reduction.

The writer has found difficulty in retaining the head of the femur in the acetabulum into which the head is reduced after an operation. It has appeared to the writer that this difficulty is perhaps due to the fact of imperfect reduction, but especially to imperfect lengthening of the string, the shortened tissues on the anterior surface of the capsule. If these ligamentous bands are short, dislocation is easy, whatever the depth of the acetabulum may be. It would appear, from the specimens examined, that the curette is not necessary in young children, as an acetabulum appears to be present.

The conclusions which the writer has formed from such experience upon the subject of congenital dislocation as has come to his knowledge are briefly as follows: (1) That the methods of treatment by traction, or by mechanical means, crutches, splints,

recumbent traction, with or without tenotomy, do not effect a cure; (2) correction by means of forcible reduction without incision can be applicable in but few cases, and is not reliable; (3) that the method of operative reduction offers the best prospect of a cure. The method at present, however, involves risks, and is not certain in its results, but it is to be expected that further experience will give greater precision and more certain results, as no inherent difficulties lie in the way of operation; that the shortening of the muscles, the shortened condition of the anterior bands of the capsular ligament (described by Bigelow as the Y-ligament), forms an important obstacle to complete reduction, and that these fibres should be thoroughly divided. It is also the opinion of the writer that these fibres can be more thoroughly divided by incising them from in front than from behind.

THE OPERATIVE TREATMENT OF CONGENITAL DISLOCATION OF THE HIP-JOINT.

By PROF. ADOLPH LORENZ,
VIENNA.

The rational operative treatment of congenital dislocation of the hip-joint follows this aim: To bring back the head of the femur to the level of the rudimentary acetabulum after upward and backward dislocation, to deepen correspondingly the cavity of the acetabulum, and to plant in it the head of the femur, either at once or after moulding it also. The operation resolves itself for that purpose into the following stages: (1) Reduction of the head of the femur; (2) hollowing out of the acetabulum; (3) (if necessary) moulding of the head of the femur; and (4) its reception into the acetabulum. The older operative procedures generally consisted of but one of three stages, *e. g.*, either the simple reduction of the dislocated head of the femur (Brodhurst), or the creating of an artificial acetabulum at the level of the dislocated head of the femur (Ogston). The results must, of necessity, be imperfect.

To our Italian colleague Poggi, of Bologna, is due the credit of being the first to introduce the head of the femur into the rudimentary artificially deepened cavity of the acetabulum and obtain a favorable result. In 1888 appeared Poggi's reduction method; it was based on the section of all the muscles as far as the capsule of the joint, by means of a semi-circular incision from the greater trochanter outward, with a view of overcoming the opposition of the beforenamed muscles to the return of the head. To the best of my knowledge, Poggi did not perfect his operation, and it remained comparatively unnoticed.

It was left for our German colleague, Hoffa, to introduce an

operation similar to Poggi's, but more perfect in its essential procedures. The method of Hoffa has as its foundation the fundamental points in the method of Brodhurst, *e. g.*, that the chief obstacle to the return of the head of the femur lies in the shortening of the soft parts surrounding the joint, namely, of the muscles passing from the pelvis to the upper end of the femur, the pelvi-trochanteric muscles. In older children it is often necessary to divide not only the pelvi-trochanteric muscles, but also those running parallel with the shaft, so as to render possible the reduction of the head. These muscles are divided subcutaneously.

The method of Hoffa is briefly as follows: Langenbeck's resection-incision; subperiosteal loosening of the muscles at the greater and lesser trochanters, subcutaneous tenotomy of adductors, and of flexors of the hip, and of the popliteal tendons; the hollowing out of the acetabulum, by means of a bayonet-scoop, and lastly, the replacement of the head of the femur. It must be emphasized, however, that this method *involves an unnecessarily great injury, inasmuch as it renders inactive ten very important muscles—the pelvi-trochanteric—robbing them, without necessity, of their points of insertion, an injury which is not compensated by the restoration of the joint.*

Since clinical experiment as well as anatomical research tends to the evidence that the pelvi-trochanteric muscles in the dislocation of hip-joint have become longer and by no means shorter, it is plain *that they will offer no resistance to the reduction of the dislocation.* There are involved in this lengthening the ilio-psoas, obturator externus and internus, the gemelli, the quadratus femoris, and the pyriformis. In like manner, the gluteus medius and gluteus minimus are also affected by this lengthening, since, in their course from their pelvic insertion to the trochanter they are thrust forward and put on the stretch by the prominent head of the femur.

The changes in the pelvis following congenital dislocation, would naturally be traced back, with certainty, to the traction of the stretched and lengthened pelvi-trochanteric muscles. The gluteus maximus alone suffers a shortening; but this muscle belongs to the pelvi-femoral group, and not to the pelvi-trochanteric, and can be relaxed by section of the fascia lata. The obstacles to this reduction of the head rest entirely and alone

upon the shortening of the pelvi-femoral muscles, which run parallel with the axis of the shaft—*e. g.*, tensor vaginæ femoris and innermost fibres of adductor magnus—and the pelvi-crural muscles—Sartorius, rectus femoris, gracilis, semi-membranosus, semi-tendinosus, and biceps femoris. Thereto may be added the evidence of clinical observation that through traction and counter-traction the pelvi-trochanteric muscles remain loose, while the pelvi-femoral muscles, especially the pelvi-crural, stand out as tense bands.

From these anatomical and clinical observations I have deduced my conclusions about my method of reduction. These conclusions are founded on the fact that *the insertion of all muscles which are not shortened must remain unchanged, and that the muscular apparatus of the hip-joint must be spared.* I have gradually perfected a method of procedure, in the reduction of the dislocation, by which all the muscles moving the hip-joint are spared. At the worst, in older children, the popliteal tendons are subcutaneously divided. The details are briefly as follows:

By means of an incision from the anterior superior spine downward between the tensor fasciæ latæ and the sartorius, the joint is exposed in front. The rectus femoris, ilio-psoas and sartorius remain intact. The acetabulum is then hollowed out, and, if necessary, the head of the femur is moulded to fit it. By powerful traction (with extension-screw, if necessary) the head is brought to the acetabular cavity. At the worst, the reduction is effected by means of the tenotomy of the popliteal tendons. In severe cases preparatory extension is to be recommended. After adjusting the head in the acetabulum the field of operation is carefully cleaned, the wound is closed, and the limb is placed in a position of slight abduction. Massage and gymnastic treatment are begun at about the fourth week after the operation, and may have to be continued for several months. The advantages of my method are, (1) the slight injury; (2) the saving of the muscular apparatus, which is, of itself, easier than the restoration of that function; (3) the acetabulum lies in the anterior part of the wound, and is thus more superficial than if it were in the posterior; and (4) the easy accessibility of the parts.

Up to the end of February, 1894, I have operated upon sixty-

three cases of congenital dislocation after this method. A particularization of all these cases will be proper only when they shall have reached a termination. A few of these cases, which were operated upon over a year and a half ago, have given so successful a result that it is impossible to detect any sign of a deformity. The aim of the operative treatment is not, however, mere improvement, but to insure a complete recovery.

At the Eleventh International Medical Congress, held at Rome, March 28 to April 5, 1894, I presented two children, aged respectively seven and eight years, who were formerly afflicted with congenital dislocation of the hip-joint, and have undergone the operation for replacement, respectively, six and sixteen months previously.

The results obtained elicited the unanimous applause of the assembly. The child which had undergone the operation but six months previously, and whose treatment was not yet ended, showed a nearly normal gait. A slight trace of the formerly very marked limp was still visible. In the other child, which had been operated upon sixteen months previously, no one could tell which was the perfect limb and which had been deformed. The gait was normal in the strictest sense of the word, and perfectly even and steady. The possession of the power of movement in the operated joint is a perfect culmination of our efforts. The shortening is less than one centimetre.

Up to the end of August, 1894, I have operated upon ninety-nine cases of congenital dislocation of the hip-joint after my method *without a single failure.* The improvement of the technique has improved also the definitive results of the operation. By the means of preparatory extension it became possible *to spare all the muscles* acting upon the hip-joint, even in the severest cases, with great shortening of the leg. In the Sixty-sixth Assembly of German Naturalists and Physicians, held at Vienna, last September (in the Surgical Section, presided by Dr. Bergmann, from Berlin), I presented no less than thirty-four children which I had operated upon for congenital dislocation of the hip-joint. One girl, who had undergone the operation only *four days* ago, could already set her foot upon the ground and walk pretty fairly. With the others the walking showed improvement in proportion to the time passed since

the operation. Among them were five who had been operated upon on both sides. Scarcely a trace of limping was noticeable. All the patients walked gracefully, and exhibited excellent form of body. Finally came those operated upon a year ago. The children marched erect, and with an almost military step, amidst an outburst of applause on the part of the illustrious assembly of surgeons.

TREATMENT OF CONGENITAL DISLOCATION OF THE HIP.

By T. HALSTED MYERS, M.D.,
NEW YORK.

Every year a very considerable number of cases of congenital dislocation of the hip present themselves at the New York Orthopedic Dispensary, and I have also seen some cases in my private practice, so that I have notes on 113 cases, but they are very fragmentary, and most of the cases have been sent away for one reason or another without treatment.

Until recent years, although occasionally a good result was recorded where all the surrounding conditions had been most favorable, the prognosis generally was altogether too poor to make either surgeon or parents undertake a course of treatment without great reluctance. Thus it happened that when these children had pain in the joint they would wear some supporting splint for a time, or use axillary crutches until the pain disappeared. If the limp was very much exaggerated, a high sole of the proper height was ordered for the short limb. Increasing in this way the elevation of this foot was theoretically bad practice, since the affected side of the pelvis was thereby raised and the more perpendicular position of the dorsum of the ilium offered less resistance to the slipping upward of the head of the femur. Practically, however, I could not determine from my notes that the cases treated with the high shoe showed any greater subsequent shortening than the other cases.

In none of my cases was there pronounced flexion or adduction. There are so many cases on record, however, which show great disability from these deformities that we must remember that they occur when we make our prognosis.

Thirty-one per cent. of these cases suffered from pain at times.

The usual story was that after jumping rope, or taking a longer walk than usual, or after carrying some weight, pain was felt in the hip. Sometimes it was severe and lasted several months; generally it disappeared after a few days' rest in bed. These attacks of pain seem to be especially apt to develop during the periods of very rapid growth. They were very common in girls from eleven to fourteen years of age. In those who did complain of pain the attacks were generally recurrent. These cases seemed to show also a considerable amount of shortening, perhaps more than the average. In one case the recurrence of pain was noted soon after childbirth, which seemed to indicate that the ligaments about the hip-joint shared in the relaxation often found in the pelvic ligaments at the end of gestation.

In many of the cases I examined there was a spinal curvature, but all were due to the short limb, and therefore were not permanent, and were easily corrected. I attempted to determine the average shortening in untreated cases at the various ages, but my series of cases was not large enough to make the results more than suggestive. I only cite those years where I have at least five cases from which to take an average. These show that between one and two years the average shortening is $\frac{5}{8}$ inch; two and three years, $\frac{5}{8}$ inch; three and four years, $\frac{6}{8}$ inch; four and five years, $\frac{7}{8}$ inch; five and six years, $\frac{9}{8}$ inch; seven and eight years, $\frac{13}{8}$ inch; eleven and twelve years, $\frac{12}{8}$ inch; thirteen and fourteen years, $\frac{15}{8}$ inch. The shortening, therefore, pretty steadily increases with growth, as we should expect.

The same may be said of the limp. This limp seems to depend, however, fully as much upon the relaxed, unsteady condition of the joint as upon the amount of shortening. Some of the patients limp badly who have but little shortening, and *vice versa.* The lordosis seems to be a very distressing and conspicuous deformity in these cases, and in many of them there is considerable pain in the lumbar spine.

The treatment to be adopted will depend somewhat upon the age of the patient when presented. Hoffa says his operation should not be done on patients over ten years of age, and adds, "the younger the patient the easier it is." Lorenz has operated upon children up to fifteen years of age, but also advises early operation.

Kirmisson considers the best age between four and six years. One of the great advantages of Paci's method is that it apparently gets good results in children too old for other methods of treatment, and in the very young as well. Therefore in children under ten years, or especially under seven years, we have a choice of several methods of treatment: the old treatment—*i. e.*, support during painful periods, and a high shoe and pelvic girdle at other times; Hoffa's operation or Lorenz's modification of this operation; Lannelongue's injections of chloride of zinc; the method of continuous extension, pelvic girdle, and, finally, walking-brace; or Paci's manipulations.

From ten to sixteen years Hoffa's operation is not recommended. In still older cases with severe and disabling deformities Kirmisson's method of subtrochantric osteotomy seems to benefit the patients considerably and without risk.

Of these 113 cases, 74 were less than seven years of age when first seen, and 88 were under ten years. Judging from my own experience, in all these cases the shortening, which is due to the dislocation, can be overcome by continuous extension. It does not by any means follow that after this the head of the femur may be replaced in the acetabulum, or that it will retain its position when traction is omitted. On the contrary, from an examination of the pathology it is very improbable that a true reposition can be made without an open operation, since the actabulum, originally shallow, is generally still further filled up, and the hour-glass form of the capsule, usually present, would itself prevent a replacement. The relatively large size of the head would also prevent this. Then, again, even if replacement were possible, there is no sufficient bony barrier to prevent the head from slipping upward again when walking is attempted. As far as I know, every case treated by continuous extension, and afterwards by walking-apparatus, has relapsed sooner or later after the apparatus was removed. The celebrated case of Buckminster Brown[1] has relapsed, and from a personal communication from Lovett I hear that Dr. Post's case[2] "has suffered a slight relapse." I have just received a letter from Dr. Max Schede,

[1] Boston Medical and Surgical Journal, 1885, No. 23.
[2] Bradford and Lovett, Orthopedic Surgery, p. 519.

however, in which he says he has completely cured four cases without operation by means of extension and the use of his splint, which holds the affected limb abducted always, even while walking. These four cases were from six months to eighteen months old when first seen, and treatment was continued for from one to four years.

I am convinced that by conservative treatment a great deal can be accomplished for these cases in some instances. The method necessitates two or three years or more of the most exacting care from surgeon and attendant, and is evidently impracticable for dispensary cases. This method has been very generally used, however, and I find that many of the surgeons to whom I sent a circular asking for information as to the results they had obtained recommended it highly, and claimed that the results were very good indeed; that the limbs were made strong and useful, and the deformity insignificant. The general tone of the replies was that, considering this to be so, an operation involving risk of life was not justifiable. A large number of prominent surgeons had never had any experience with these cases.

In one case I have had under treatment I pulled the head down to its normal position by a long traction hip-splint. I also applied a pelvic girdle with a crescentic pad over the trochanter to make pressure and prevent slipping upward. Nine months later I began to move the hip in its new position carefully in order to create a new joint. The head of the femur seems under treatment to have changed its position considerably, as it is now almost over the acetabulum instead of on the dorsum. A much firmer support is afforded here by the anterior-superior spine and its muscles, and less lordosis is caused. This position is, I think, the best one to be gained, if the head is not actually replaced in the acetabulum. In this case the shortening has increased very little, if at all, in the five years she has been under treatment. This change from a dorsal to an upward dislocation as a result of mechanical treatment I have not seen reported, but it has occurred after operations where the capsule was not opened—the head slipping upward after the operation into this position. In the case I have described, however, there is still so much abnormal mobility that I doubt whether the improvement will be permanent after the brace is removed.

Injections of a ten per cent. solution of chloride of zinc are recommended by Lannelongue[1] for the purpose of exciting a bony growth at the site of the injection.

Lannelongue[2] says his proceeding may produce a certain amount of arthritis and thickening of the soft parts, but that this is advantageous. The long hollow needle of a Prâvaz syringe is carried down to the bone and the injections made as much as possible subperiosteally. The injections may be repeated after three weeks to insure success.

In a child three years of age he made eight punctures, and in each deposited about two drops of the ten per cent. solution. In a second operation on the same child, three weeks later, he injected twenty drops, making two semicircular rows of punctures, one centimetre apart, for the purpose of increasing the bony deposit.

The only bad symptom was a little fever after the second operation. Two weeks after the second operation a bony projection was apparent below the crest. It was deep-seated and attached to the ilium, hard and very prominent, and surrounded the great trochanter above and behind. Lannelongue also immobilized the hip, and used continuous extension to keep the head in good position during this treatment. The result seemed good in this case, and he reported it to the Congress of Surgeons, in 1891, as a cure.

Coudray[3] reports a cure by this method obtained in a girl three years of age. After reduction of the shortening of three centimetres by Paci's method, two injections, at two months' interval, were made. Continuous extension in bed was maintained for five months. A month later the great trochanter was only one centimetre above Nélaton's line. The child was not allowed to walk, however, before the end of the year. This case remained cured, and was reported to the Congress of Surgeons again in 1893.[4]

Jeuvell[5] reported three cases treated by these injections, repeated from two to five times. Two were cured, one of them a bilateral dislocation.

These are the only cases which I have been able to find reported as yet. The method is so simple that if it is as free from pain

[1] Semaine Médicale, 1891, p. 510.
[2] Bulletin et Mémoires de la Société Chirurgie, Paris, 1891, xvii. p. 770.
[3] Congrès Français de Chirurgie, 1892, p. 714.
[4] Annales d'Orthopédie, December, 1893.
[5] Ibid., August, 1893.

and danger as its author claims it would seem a valuable addition to our treatment, especially after reduction has been attempted without opening the joint.

Gussenbauer[1] attempted to excite this new bone-growth by opening the joint by Langenbeck's incision and inserting two or three steel nails in the posterior rim of the acetabulum. They were left *in situ* six weeks, but the results were not good. In one case the bone was so thin that the nails would not hold at all.

Resection of the hip-joint has been done a number of times for this deformity, but the results have been, as far as I know, always bad where both joints were affected, and generally bad also in unilateral cases, so that this operation is not to be recommended.[2] In some very old and extreme cases, however, the head of the bone is so misshapen that it must be removed. Lorenz[3] has occasionally found these extreme changes even in young subjects—once in a child two and a half years old.

König's[4] method of deepening the acetabulum by raising a periosteal flap from the ilium, inverting it, and sewing it to the capsule, has been practically abandoned.

Karewski,[5] in February, 1889, opened the joint by an anterior incision and replaced the deformed head of the femur. It was a case of paralytic subluxation. This is the first, he claims, in which "bloody replacement" of the dislocated hip has been successfully done. By January, 1890, he had operated four times, and found that after the dislocation had existed for some time the acetabulum had to be enlarged to receive the head of the femur.

Hoffa[6] published his operation in April, 1890, for the first time. To his energy and scientific work, however, is due the greatest part of the popularity the operation known by his name enjoys.

He has very kindly sent me the advance sheets of the new edition of his work on orthopedic surgery, and I will briefly outline his operation there described:

"Opening the joint by Langenbeck's incision; division of the

[1] Annales d'Orthopédie, May, 1893.
[2] For reports on twenty-seven of these cases, see "Lovett's Diseases of the Hip," p. 207.
[3] Wiener klinische Wochenschrift, 1894, Nos. 11, 12, 13.
[4] Verhandlung der deutsche Gesellschaft für Chirurgie, Berlin, 1891, xx. pp. 1-75.
[5] Centralblatt für Chirurgie, 1892, No. 36.
[6] Verhandlung der deutsche Gesellschaft für Chirurgie, xix Kongress, p. 944.

capsule at its insertion in the neck of the femur; subperiosteal freeing of the great trochanter from all the muscles attached to it. In patients under five years old it is then almost always possible by flexion of the thigh and direct pressure upon the head to bring the head into the old acetabulum. The hip and knee now are often seen to be flexed. Hoffa overcomes this in young children by holding the head firmly in the acetabulum while an assistant gradually extends the leg on the thigh, so stretching the biceps, semi-membranosus, and semi-tendinosus. This is accomplished in three to five minutes.

"In older children, six years and upward, it is generally better to divide these muscles, and this is done before opening the joint. Hoffa has adopted Lorenz's recommendation of dividing them at the tuber ischii. The limb is now abducted, and the adductors subcutaneously divided. The limb is now hyperextended and the soft parts attached to the anterior-superior spine of the ilium and the fascia lata are divided by the open method so as to control better the hemorrhage. These wounds are now dressed, and then the joint is opened as described above. The head must be freed so completely that it can readily be brought out of the wound. Hoffa has never seen any necrosis of the head follow this free division. The ligamentum teres, if present, must be extirpated, and the insertion of the capsule into the neck freely divided. A sharp Volkmann spoon, bayonet-shaped, is now guided by the index finger to the acetabulum, and the fatty tissue and cartilage and a good deal of spongy tissue are scraped out, taking care to preserve the edges of the acetabulum. The cavity must be made not only deep but broad. This is best accomplished by cutting away posteriorly.

"The head is now reduced, and goes into place with a snap. It there is a rotation forward of neck and head, the limb must be put up in moderate inversion, otherwise the head will slip out of the new acetabulum. After a few weeks it may be brought to the normal position. Lorenz, also, in such a case advises putting the limb up in inversion, and a subsequent subtrochanteric osteotomy to correct this. The superfluous part of the capsule is extirpated, and the wound packed with iodoform gauze.

"Small children are put in a fixation bed, with the limb abducted;

older children in an extension dressing. In bilateral cases both sides may be operated upon at once.

"Hoffa has operated seventy-five times now. All but the fatal cases were greatly improved by the operation. He wishes it understood that these children cannot be completely cured, since there is always more or less impairment of the nutrition of the limb independent of the shortening due to the displacement.

"In bilateral cases he can reduce the waddling gait to the minimum, and can almost completely overcome the lordosis.

"In unilateral cases he corrects the scoliosis and the shortening of the limb which is due to the dislocation. The limp which remains is not the characteristic disfiguring one of congenital dislocation, but that of a short leg. The new joint is firm, the motion is good, and is better the younger the patient is when operated upon. Ankylosis only occurs where there is suppuration, or where the acetabulum is not made broad and deep.

"The first fixation dressing is kept on three to four weeks. Then massage and careful passive motion are used. After five weeks the child can stand and walk in apparatus which allows motion at the hip, but does not allow the head to escape from the acetabulum. This apparatus is worn until the joint is fully consolidated —that is, for several weeks or months, according to the age of the patients. Bilateral cases wear only a supporting corset. At first the movements are not very easy on account of the imperfect adaptation of the head to its socket, but after walking, a return to the natural shape follows the restoration of the normal relationship between the articular surfaces."

Lorenz's modification of Hoffa's operation consists in opening the joint by a vertical incision directly below the anterior-superior iliac spine. The capsule is very easily reached in this way, and is laid freely open by a crucial incision and the acetabulum gouged out with less danger of injuring its posterior rim. Lorenz first laid especial stress upon the fact that the main resistance to reduction was offered by the muscles whose fibres took the direction of the shaft of the femur rather than those inserted in the great trochanter. Hoffa had spoken of the resistance offered by the muscles inserted into the tuber ischii and the anterior iliac spines, but had not realized apparently that this was the main resistance.

Lorenz,[1] on the other hand, now finds that the gluteal muscles have fibres running parallel with the shaft, and therefore these fibres may offer resistance to reduction. These fibres are only in those parts where these muscles overlap each other.

Lorenz has also, I understand, modified his operation by making a transverse incision directly outward from his vertical incision in order to afford still easier access to the acetabulum. In his latest report, however, he says he has devised a new method which will require the division of only one muscle, the tensor vaginæ femoris. The details he has not as yet published. By his old method he often does not divide at all the muscles inserted into the great trochanter.

He treats his cases after the operation just as Hoffa recommends. In some cases, where there was great deformity of the femoral head and a short neck, he found it necessary to put the limb up in considerable abduction in order to prevent it slipping up, and while this was not objectionable in unilateral cases it would be so in bilateral cases if this position needed to be permanently maintained.

Both Hoffa and Lorenz advise now against any attempt to reduce the dislocation without opening the capsule and deepening the acetabulum. Such cases were found to relapse.

Broca uses a Langenbeck incision, but places it further forward, so as to reach the muscles attached to the anterior iliac spines more easily.

Kirmisson[2] makes an incision from the anterior-superior spine to the great trochanter, then down the shaft of the femur. In this way the insertions of the trochanteric muscles are easily detached, and the most direct access to the capsule is gained. He does not think the acetabulum can be enlarged, as Hoffa says, unless the excavation is made upward, which would necessarily cause shortening. He now voluntarily perforates completely the acetabulum, believing that the thick fibrous and muscular planes behind the acetabulum will protect the peritoneum from injury.

Kirmisson[3] has also lately reported some very good results obtained in old neglected cases with flexion and adduction by means of subtrochanteric osteotomy.

[1] Wiener klinische Wochenschrift, 1894, Nos. 11, 12, 13.
[2] Revue d'Orthopédie, 1894, No. 3, p. 219.
[3] Ibid., 1894, No. 2.

Ogston[1] and others have reported good results in this class of cases by resection of the head of the bone and the formation of a new acetabulum on the dorsum of the ilium.

Paci's method of treatment consists in forcibly manipulating the limb as if to reduce a traumatic dislocation—that is, the limb is first forcibly flexed as far as possible, then abducted, then rotated outward, then extended. Afterwards the thigh is held completely extended and immobilized, and traction is applied. If the shortening is not completely overcome at the first operation, a subsequent one will probably accomplish the reduction.

In about two months the plaster-of-Paris splint is removed and an extension apparatus applied. About four months after the operation the patient is allowed to get up and walk with crutches. At night the extension is reapplied. The limb is massaged twice daily, and once a day receives electrical treatment.

Danger of the Different Methods.—There is no danger in the mechanical methods, of course, and none whatever in Paci's. Lannelongue's injections of chloride of zinc have thus far been harmless, but cause more or less pain, and in one case considerable fever for a few days.

I have notes of 177 cases of Hoffa's operation or some of its modifications, and among these are six deaths which may have been due directly to the operation. The mortality is therefore about 3.3 per cent.

Hoffa had two patients die a few hours after the operation, which in both cases was long and difficult. He ascribes these deaths to the narcosis, but he thought the hemorrhage and shock also contributed.

His third death occurred twenty-four hours after the operation, and was probably due to iodoform intoxication, together with the shock and loss of blood. The girl was fourteen years old.

Kirmisson[2] had one case die from hemorrhage and peritonitis, eight days after the operation, following perforation of the acetabulum. He used a gouge and mallet, which would appear to be more dangerous than curetting. His second death[3] also followed perforation of the acetabulum. The boy was seven years old, the

[1] Annals of Surgery, St. Louis, 1888, viii., p. 161.

[2] Revue d'Orthopédie, January, 1893.

[3] Ibid., January, 1894.

operation long and difficult. He died of septicæmia, but the condition of the joint showed nothing.

It would thus appear that Kirmisson's modification of Hoffa's method is a dangerous one, or his technique is defective.

Broca is reported to have had one death, but I cannot find the reference, and do not know whether it was due to the operation itself or to some other cause.

Under strictly aseptic conditions it seems to me the operation should not be dangerous. On account of the irregular shape of wounds, however, and the fact that the replaced head will act like a cork and retain any germs present, infection must be most carefully avoided. The position of the wounds also, especially in young children, will require great care to prevent the dressings becoming soiled and the occurrence of secondary infection.

Hoffa[1] showed a case of bilateral dislocation operated upon over three years before. There had been no relapse. There was no lordosis, no waddling gait; the joints were sound, and showed very good motion. The child ran about all day without pain or fatigue.

He presented two other unilateral cases, which showed firm joints and good motion. One, a girl of eight years, operated upon three years ago; the other, two and a quarter years old, operated upon one year ago.

He said: "In all my other cases equally favorable results were obtained, after operations made in the manner recommended." Dr. Hoffa is an enthusiast, and states his case strongly, so I feel a little hesitancy in accepting such a broad statement without more details being given. The saving clause "after operations made in the manner recommended" *may* exclude some cases.

Lorenz, however, is also very enthusiastic in regard to his operation. He considers three to four years the most favorable age for operating, and does not like to operate after seven years. He thinks the distortions of the head and neck sometimes contraindicate the operation. These distortions can often be made out before operation.

He has now operated on sixty-three cases, and has recorded no

[1] Verhandlung der deutsche Gesellschaft für Chirurgie, Berlin, 1893, xxii. 12.

death, and but three relapses, which were due to anteversion of the neck. He often completes his operation in twenty minutes.

He reports[1] a very bad result from his first operation, in which he followed Hoffa's method, and which made him devise his own. Suppuration ensued, the knee also was infected, and finally there was a relapse of the deformity.

He reports this case among others: Girl, eight years old; operation December 29, 1892. Fourteen months later absolute anatomical and functional cure. Not the slightest limp; runs, jumps, etc. Flexion from 180° to 90°. Abduction, adduction, and rotation free; muscular power as good as that of the other side.

In Karewski's five cases[2] the femurs remained in place at first with free motion. In two of them the orthopedic apparatus was removed too soon, and they are beginning to relapse. One did well until he died of scarlatina. Two walk almost naturally now, eighteen and twenty-four months after the operation.

Karewski thinks cases of paralytic dislocation should give better results than the congenital dislocations, because the acetabulum is probably better formed in the former.

Schede[3] reports the results he has obtained in seven cases treated by Hoffa's operation. The patients were from four to twenty years of age. The shortening was greatly reduced in each case, and after the operation in no case exceeded two centimetres. The limp was in each case much improved, as was also the ability to walk about. One case suppurated, and in two a tendency to a recurrence of adduction and flexion had to be corrected by brisement.

Paci[4] reports on fifteen cases, and they are almost perfect a year and more after operation. He says Redard, Nota, Regnoli, Motti, Rota, Ceci, Oliva, and Galbozzi have examined some of his cases, and were greatly pleased with the results he had obtained. On the other hand, Kirmisson reports seeing[5] a case said to have been reduced in this way, but which was not. The head of the femur was directly above, not in the acetabulum. The functional result, however, was very good.

[1] Centralblatt für Chirurgie, 1892, No. 31.
[2] Centralblatt für Chirurgie, Leipzig, September 10, 1893.
[3] Personal communication, May, 1894.
[4] Archivio di Ortopedia, Anno ix., No. 6, and idem Anno x., No. 1.
[5] Revue d'Orthopédie, May, 1894.

I cannot myself understand how it is possible to get and maintain such good results as Paci reports when we consider the pathological conditions present. And, theoretically, I cannot see how he can expect to get any better results than have been obtained by the method of gradual extension, immobilization, and protection, which has been so long and widely practised. He obtains his reduction at once, however, and this is a very great advantage, hardly to be overestimated, and the traumatism inflicted may also help to secure the head of the bone in its new position by exciting an inflammatory exudate. The children he reports are from eight to sixteen years of age, and the results are most excellent a year and more after the operation.

It would thus seem that this is the method to be first tried at any age. If this does not succeed we may try in addition injections of chloride of zinc, and later still, if the child is not over ten years old, Hoffa's operation, or Lorenz's modification of it, which seems to me preferable. If we have to do with an old, deformed, or painful case, Kirmisson's subtrochanteric osteotomy may be done, or Hoffa's new operation, in which the head of the bone is sawed off at the inter-trochanteric line, the posterior part of the capsule cut away to allow direct apposition with the ilium, and the limb put up in abduction. Walking with a supporting apparatus can be begun then after about three months.

Redard's observations[1] agree with my own that after the bloody reposition—

The number of perfect cures is very small.

The number of cases improved is large.

The results in double dislocations are not so favorable as in single.

The lordosis is generally corrected.

A slight spinal curvature generally persists, owing to the atrophy of limb and pelvis.

The limp persists to some degree almost always, though, if the posterior dislocation is relieved, a high shoe will correct this limp almost if not quite perfectly.

When we consider that these cases will certainly become more

[1] Traité de Chirurgie orthopédique, Paris, 1892, p. 534.

and more deformed as they grow older, that about one-third of them will have repeated attacks of pain and disability, and that many cases are reported where the patients are rendered helpless by the flexion and adduction of their limbs, it seems to me we ought no longer to send them away without treatment. The mortality of Hoffa's operation is less than it is generally believed to be. The improvement in technique has made it much easier and more rapid, and the results are improving. And better still, Paci has made it possible by his rapid method to treat many cases that could not afford the time and attention demanded by the older methods.

In view, then, of these good results, and the even more promising character of the latest reports, we may undertake the treatment of these cases with the assurance that we can benefit them very materially in a comparatively short time.

DISCUSSION.

Dr. R. Whitman said he had given Dr. Monks the credit for reporting a case of bending of the neck of the femur, although Dr. Monks unfortunately attributed the deformity to arthritis deformans. On studying the description of the case it seemed to him a clear case of bending of the neck of the femur.

To continue the discussion of congenital dislocation of the hip, Lorenz had reported quite recently sixty-three cases of operation. His modified method was practically the same as that presented here by Dr. Bradford, viz., opening the joint from the front, then making a cross-cut to the trochanter, thus allowing much better access to the joint. The speaker said he had assisted in five cases, and had seen Hoffa himself operate on one case, which proved, however, very unsatisfactory, for the reason that adduction began immediately, and had continued ever since. He had also examined one case that died of diphtheria after this operation. The autopsy showed that the neck of the bone was bent forward at a marked angle, and that the acetabulum had not been cut out deeply enough. He agreed with Dr. Bradford as to the obstacles to reduction and approved of the Lorenz operation, which necessitated

division of the anterior portion of the capsule in the manner advocated by Dr. Bradford.

It was true that the mortality was still rather high, and the final results not entirely satisfactory; still, he did not think that the great disability attendant upon congenital dislocation was generally appreciated. The statement had been made in New York quite recently by a prominent surgeon, that he considered that the results in congenital dislocation were so good as to contra-indicate operation. He had had an opportunity of seeing twenty-five or more cases a year. When double, there was a tendency to a steady advance upward on the pelvis, and the limp and deformity were infinitely worse than a very bad result after hip-disease, and the patient might even be unable to walk with comfort. It was not true that they had no pain, for they suffered a great deal. If one could fix the bone simply in a one-sided dislocation, one would confer a great benefit on the patient.

He wished to express his obligation to Dr. Bradford for the opportunity of seeing the depressed neck of the femur. A number of similar specimens had been described, but the significance of the affection had not been understood until the publication of Müller's paper in 1889.

The President asked Dr. Whitman if he would attribute the bad results to the infection and abscesses, or to the operation.

Dr. Whitman replied that he did not attribute it to the suppuration; this should have held the head of the bone more firmly in the acetabulum. It was extremely important to make a very large acetabulum, and he could not understand, if one were very careful, what particular harm would follow if perforation of the pelvis should occur, provided no suppuration followed the operation.

Dr. John Ryan said that the hip-joint specimen was of unusual interest. He wished there were some facts regarding the microscopical condition of the bone. In the specimen showing bending of the femur, the condition present seemed quite different from what Dr. Whitman had presented. In the specimen the neck was completely obliterated, and the head of the bone was pear-shaped;

hence it could not be due to the rickets of adolescence, but the rickets of infancy.

Although he saw about half a dozen cases of congenital dislocation each year, he could not recall a single one in which there had been any pain. The only signs had been lameness and quick tiring out on walking. He could readily understand that with the greater development of the body, and increased weight and strain on the muscles and ligaments, that pain might be a later symptom.

Dr. Louis Weigel agreed fully with Dr. Whitman in the statement regarding the great amount of disability associated with double congenital dislocation, particularly in patients of from ten to fourteen years.

The demonstration given by Dr. Bradford was exceedingly interesting and suggestive. In his experience he had not met with cases in which there was any great resistance to the reduction of the deformity, and he had never seen a case in which the condition of abduction existed; in other words, by flexion, rotation, and then extension, he had been able to bring the leg down to its normal length. He had never seen such a case in children over three or four years of age.

For some time past he had been of the opinion that there was a difference in the degree of lack of development of the acetabulum which had been considered the possible cause of the deformity; and hence he thought some cases might be relieved by continued contraction with the object of simply maintaining the head in the proper position. It would seem that something more than a rudimentary acetabulum was necessary to hold the bone in place, and the specimen just presented confirmed this view.

Dr. De Forest Willard, of Philadelphia, said that if all cases of congenital dislocation were like the specimen just presented, there could be no question about operative interference being the proper procedure, but he thought there were many cases in which the pathological conditions found would be very different. He did not see many such cases, but from those specimens he had seen, and from clinical experience, he believed that the acetabulum was usually more seriously deformed than in this specimen. Where there was a

long, oval-shaped acetabulum he did not believe operation was likely to be so successful. He had seen great disability, but he had never seen these patients suffer local pain, or, indeed, any pain except the muscular pains and tiring resulting from the swaying of the body.

Dr. Bernard Bartow, of Buffalo, referred to a case under his care at present. A child, about three years of age, with unilateral congenital dislocation, had been sent to him as a case of hip-joint disease. When he first saw the child there appeared to be an exacerbation of inflammation in the hip-joint, and the only question in his mind at that time was whether or not the child had been lame ever since it had begun to walk. A satisfactory examination could not be made at once on account of the condition of the child. After having been kept quiet for a few days all these active symptoms disappeared. Dr. Weigel, who saw the case at this time, diagnosticated it as one of congenital dislocation.

While it was easy to dislocate and reduce the dislocation of the head of the femur, it was found that after traction-treatment continued for a period of about six months the head of the bone remained in the acetabulum, and was not dislocated by the application of a reasonable force. This would seem to show that there was, perhaps, not so complete an arrest of development as was found in some other cases. He had already made one injection into the hip-joint with a view to setting up a low grade of plastic inflammation with the hope that this would bind the head of the bone more firmly in its new position, or even produce more or less ankylosis. It seemed to him that this treatment held out some hope of success.

The speaker also referred to a case in the Buffalo Hospital, where the symptoms pointed to anterior dislocation on one side and posterior dislocation on the other side. The case was not seen by him when the anterior dislocation was supposed to have existed. The physician in attendance at that time stated that he had been able to reduce it after quite free separation of the muscular attachments; therefore the head of the bone was excised by him. A natural result was that the shaft arose to a higher point, so that the length of this limb was about equal to that of the other limb, in

which there was a dislocation. On the dislocated side the end of the shaft had formed an attachment which would ordinarily be sufficient to sustain the weight of the child. If there had not been paresis of the limb the function would have been called good. The only thing to obtain now was ankylosis of the limb.

Dr. W. E. Wirt said he had seen cases of congenital dislocation of the hip where there was actual pain in walking. He would like to ask Dr. Bradford what proportion of cases had as good an acetabulum as that seen in the specimen. He would also like to know regarding the effect of injections of a 10-per cent. solution of the chloride of zinc in a semicircle around the joint. Such a method had been reported some time ago, and it was claimed that it had resulted in the development of a useful ring of bone.

Dr. Whitman said he would like to emphasize again the point that these patients did suffer pain. Only last week he had seen a child seven years old where the pain had been so great that the parents had urged an operation, although they were told that there was not much hope of success. The reason pain was not ordinarily observed was probably because most of those seen were young children. It was impossible to conceive of such great changes occurring as those found in the pathological specimens, without the existence of pain.

Dr. Ryan said he had not seen such cases among babies in arms. All those he had observed had been walking cases.

Dr. Whitman said he had not intended to refer to infants, but to children of from three to eight years of age. After these patients began to undertake the work of life the pain increased.

Dr. Weigel said that about six weeks ago he had examined a boy, two years of age, who had congenital dislocation. The dislocation was easily reduced by manipulation, and the long traction splint was applied. After about five weeks he was unable by any direct pushing force to dislocate the bone; hence, in some cases, there seemed to be a certain amount of development of the ace-

tabulum, and consequently, a certain amount could be done by mechanical treatment.

Dr. A. M. Phelps said he was very glad to see this specimen. About three years ago he had presented a pathological specimen—an anterior dislocation toward the anterior-superior spine. Dr. Ridlon had already reported a case of that kind. These dislocacations could take place in almost any direction, and the result in a given case must depend largely upon the character of the dislocation and the time of the operation. These operations were imperatively demanded, and were justifiable, he believed, because up to this day there had never been a single case of congenital dislocation of the hip cured without operation. He had never seen a case of congenital dislocation of the hip cured until he had visited the Würzburg clinic, and had seen a case at Hoffa's house. It was the one reported in his book. That case was the only one of the kind that he had ever seen cured by operation. Hoffa had other cases which, if they were not cured, had been so much benefited that he would be led to do the operation. Understanding, as we did, that by operative work we might succeed in curing these cases, and knowing that mechanical treatment amounted to almost nothing, we should resort at once to operation, except in those cases where operation was positively contra-indicated. Hoffa had stated to him that he did not like to operate in any case of congenital dislocation of the hip after the fourth day. The perforation into the pelvis, if important vessels were not injured, or if suppuration did not occur, was of very little moment. The speaker said he believed that very soon Hoffa's operation would be accepted, and would be for a while followed by bad results, as after all other new operations; but if we cured one in twenty-five, this would still be an advance over the past. He had himself done two excisions of the hip for congenital dislocation, and the results in those cases had been about what was observed after excisions for hip-joint disease. A large opening was made in the pelvis, into which the end of the femur was placed. Bony ankylosis, unfortunately, did not take place. There was very much more motion than was desired. Excisions were, of course, calamitous, and if the head and neck could be saved as in Hoffa's operation, it was very important. He was de-

cidedly in favor of giving the operation a fair trial. If suppuration occurred, there would be reflex spasm, and this would result in serious deformity. In a case recently presented by him at the New York Academy of Medicine, the bad result was due, in his opinion, to hip-joint disease.

Dr. Bradford said, regarding the remarks of Drs. Wirt and Willard that the specimen appeared to be an exceptional one, that he could only speak from the specimens he had seen. The specimen just presented was from a child of eight years; there were not many such specimens in the museum. He had examined three other dried specimens at the Warren Museum. In all these there was evidence of an acetabulum, but at the upper and posterior edge in the older cases there was a ridge of bone, due to pressure downward of the dislocated head. The acetabulum seemed to be narrowed by this ridge of bone. This would occur in older cases. His impression was that this did not exist in children, and that congenital dislocation was really congenital, and was not an arrest of development of the acetabulum.

He would like to confirm what Dr. Whitman had said about the pain and disability found in certain cases of this condition in adults. He had two patients, working women, both of whom were practically disabled.

Regarding the advantage of obtaining healing by first intention in Hoffa's operation, he would say that in the two cases dying of diphtheria, in which suppuration occurred, the disadvantage of suppuration was manifest. Theoretically he would agree with Dr. Phelps, but all cases of congenital dislocation did not have disability. He had seen adult cases without much disability. At present we could present the patient with a series of statistics which did not give a certainty of cure. He believed that they could be cured, and that every one of us, after a series of four or five experiments, would cure all the cases. Hence, he would favor mechanical treatment where this held out any prospect of success.

Regarding the case of softening of the neck of the femur, he would say that the specimen he had presented would pass for an alteration in the neck of the femur from softening and weight.

Although the head was misshapen, the alteration was such as came in the bones as a result of weight. It was not a fracture.

He wished to assume the responsibility for the diagnosis in the case reported by Dr. Monks. The diagnosis had been made of rheumatism, and the condition was a puzzling one. The patient certainly did not have hip-disease.

Dr. Bradford also presented a specimen of rhachitic deformity of the hip from an adult subject; and also a knee-joint showing a periostitis just above the head of the tibia, which was the source of the pus which had been found in the joint.

REPORT OF A CASE OF CONGENITAL DISLOCATION OF THE LEFT HIP, ASSOCIATED WITH SPASTIC PARALYSIS OF THE LEFT ARM, BLINDNESS AND DEFECTIVE MENTAL DEVELOPMENT.

By LOUIS A. WEIGEL, M.D.,
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The following case is of interest on account of the multiplicity of abnormal conditions:

In June, 1893, Dr. M. Craig Potter referred to me for examination a male child aged two years and four months. The mother gives a history of having had a difficult labor with this child, on account of a foot presentation. There was no asphyxia at birth, but for the first three or four days the child had a number of convulsions. For several months after this it "did not seem to have any life." The abnormal condition of the hand became noticeable early in infancy; the disability of the leg, however, was not observed for some time. The boy never crept like other children, and made no attempts at standing or walking. He has a violent temper, and is rather inclined to be vicious and destructive.

Upon examination the spastic condition of the left hand and arm is found to be very marked, considerable force being required to open the hand. The left leg is one inch shorter than its fellow; motion is abnormally free; flexion and abduction not marked. The head of the femur is freely movable upon the dorsum of the ilium. With a slight amount of traction and rotation the leg can be brought down to its normal position, where it remains for a short time. Any slight muscular exertion readily reproduces the displacement. I was unable to determine the existence of a rudimentary acetabulum. As stated above the child had never walked.

An ophthalmoscopic examination shows that the blindness is due to a double optic neuritis and secondary atrophy from some intracranial cause. The mental development of the child is very defective, though he gives evidence of some intelligence and memory. An outline tracing of the head in August, 1893, seems to show marked symmetry.

Although the case seemed rather hopeless, the mother was anxious to have something done, and treatment was accordingly undertaken.

A long traction splint was applied to the leg for the purpose of maintaining it in proper position and enabling the child to stand or walk. For the spastic condition of the hand massage and manipulation were ordered. This treatment has been faithfully carried out for several months.

I had an opportunity to examine the child again three weeks ago, and was surprised to find so much improvement in some of the conditions. The mother reports that a few weeks before he began to stand, and that for three weeks he has been walking about, and is steadily improving. The hand is also very much better; he opens it voluntarily now, and uses it in a more natural way. From this favorable report I expected to find an actual improvement in the physical condition of the hip, but as a matter of fact, when the splint is removed, it is just as readily displaced as before and as easily reduced.

His mental condition has undergone a marked change for the better. He is now able to formulate sentences, appears to have a good memory, and seems to be very much brighter; in fact the mother thinks he is as far advanced as the average child of his age. This latter statement, however, I think must be taken with a considerable margin of allowance.

The combination of conditions in this case is an unusual one. The spastic paralysis and feeble-mindedness are undoubtedly due to a cerebral hemorrhage occurring during birth, and which subsequently produced organic changes in the brain tissue. Whether or not this hemorrhage was also the prime cause of the optic-nerve affection I am not prepared to say. Were it not for the fact that the mother was unattended in her labor either by physician or midwife, one might be inclined to regard the hip displacement as of traumatic origin. So far as I can learn, the delivery of the

child was spontaneous, and no violence was done during birth. Arrest of development *in utero* must, therefore, be accepted as the probable cause of the dislocation of the hip.

Shortly after this case came under observation another child was brought to me in a somewhat similar condition. In this second case the mother gives a history of a perfectly normal labor of short duration. The child, a little girl, now three years of age, presented nothing unusual at birth, and appeared to be properly developed. Soon afterward, however, the mother noticed an abnormal condition of the right hand, and when the child began to walk it had a decided hip-limp. Upon examination I found that she had a well-marked spastic condition of the arm and hand and a congenital displacement of the right hip. The leg is one-and-one-half inches shorter than its fellow, and abnormally free in its movements. By manipulation the hip dislocation is readily reduced. The acetabulum appears to be slightly developed, and its location is readily determined. The mental development is normal.

In this case there is no history of a severe labor, premature birth, asphyxia, or instrumental delivery to account for a probable cerebral hemorrhage and subsequent spastic paralysis, and yet the tonic contraction of the muscles of the arm is even greater than in the first case. The dislocation of the hip can probably be traced to the usual cause, *i. e.*, the arrest of development.

DISCUSSION.

Dr. Benjamin Lee, of Philadelphia, said that he had seen a certain case of this kind for the first time some sixteen or eighteen years ago, and that then there was a spastic contraction of the left arm. After being treated for a short time she moved to the West. An operation was performed there by means of which the contraction of the elbow was overcome, but the hand remained still somewhat contracted. Two or three weeks ago, the family having returned to the East, she had been brought to him, suffering from pain extending from the hip to the knee. She stated that within a year she had had a severe fall and a sprained ankle. There was

also some spastic contraction of the ankle, which perhaps accounted for the position of the foot. On examination of the foot, it was found that the direction of the gluteal crease was altered, that there was slight elongation of the limb, and some interference with adduction—in fact, all the movements of the joint were somewhat restricted. He had not been able to make up his mind whether this was a case of traumatism to the hip, or whether it was connected with the spastic condition. If the latter, it was quite similar to this just described in the paper.

Dr. F. S. Coolidge, of Chicago, said that the two cases reported in Dr. Weigel's paper were quite peculiar. From the fact that one arm had gotten rapidly better, it had occurred to him that the dislocation of the hip might have been due to a prior condition of the brain, causing spastic contraction of the foot sufficient to bring the foot out of its socket. He believed that it had been suggested that congenital dislocation might be due to such a severe spasm.

Dr. Phelps asked Dr. Weigel if there was any evidence of paralysis.

Dr. Weigel replied that the boy had never made any attempt at walking until about three weeks ago. It was not a true paralytic condition of the leg muscle, and there was not the amount of atrophy one would expect to find in a paralytic condition. With reference to the remarks of Dr. Coolidge, he would remind him that the spastic condition of the muscles existed during intra-uterine life. According to the present idea, spastic paralysis was commonly due to some unusual condition at first, but there was no such history in either of the cases he had just reported.

INFANTILE SCORBUTUS AND ITS RELATION TO ORTHOPEDIC PRACTICE.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

It has been known for some years in England and in Germany that infants and young children deprived of fresh food sometimes develop true scurvy. This condition may complicate rickets, but is distinct from it, and often appears in non-rickety subjects. It is liable to occur in nurselings after a prolonged use of any substitute for fresh milk. Some authorities claim that sterilized milk has caused scurvy; if the milk is kept at 212° not longer than fifteen or twenty minutes it is probably safe, but sterilization at 167° (pasteurization) is to be preferred. The conditions under which scurvy develops are such as to throw physicians and parents off their guard and to lead to errors in diagnosis, especially as this disease in infants has been till recently little known in this country. The artificially fed children who afterward develop scurvy may relish their food and appear hearty, rosy, and well-nourished for months, and are often remarkably free from stomach and bowel complaints, even after scurvy has developed, so that the insufficiency of the diet may escape notice. At the age of six to eighteen months the baby begins to fail in health, grow peevish, restless, and sensitive and develops a peculiar cachexia, characterized by a dusky complexion and emaciation. If the child has cut teeth or is about to cut them, the gums in their vicinity usually become dark, swollen and spongy; later there may be ulcerations, bleeding, and fetor. Whether the gums become implicated or not, the general sensitiveness increases and finally becomes so intense that the child lies motionless and can be handled only with great difficulty. At the same time fusiform swellings due to the effusion of blood beneath

the periosteum appear near the hip, knee, or ankle. These swellings are exquisitely sensitive, and may be large, tense, and shiny, but are devoid of local elevation of temperature. There may be fever in the acute cases.

Though the baby may be on the verge of dissolution, a simple change of diet to raw or pasteurized milk, with the juice of an orange and perhaps a little raw beef-juice daily, will cause the subsidence of all symptoms in an incredibly short space of time, unless some accident, such as the separation of an epiphysis, has occurred.

The following case[1] sent to me last summer from the South for the treatment of supposed Pott's disease or hip-disease will illustrate the main points of the symptomatology :

A little girl, eleven and a half months old, had been fed exclusively on a special brand of condensed milk, upon which she had seemed to thrive up to the age of six or seven months ; at six months of age she was rosy and weighed twenty-five pounds. The local symptoms, noticed in their order of appearance, were weakness in sitting, and a peculiar bent attitude, later inability to sit up; indisposition or inability to move the legs, and later the trunk; a tender swelling on the right thigh, disappearing in a few weeks; spongy and bleeding gums ; a "heat rash" over the body ; swelling about one eye, disappearing in a week or two. During the development of the symptoms the baby's nutrition became much impaired, and she lost appetite and flesh, and slept badly. She also became peevish and excessively sensitive to the slightest touch or movement. For several weeks before her visit she had been very weak and cross, and had perspired profusely. At no time had there been noticeable disturbance of the stomach or bowels. At the time of her examination her condition had become critical, as she had almost ceased to take food; the rectal temperature was $102\frac{1}{2}°$; the skin was dusky and covered with a papular eruption. The face had an anxious expression, indicating severe and continuous suffering. The baby resented with loud outcries any attempt to handle or even to approach her, and in crying she exposed her purplish swollen gums from which the eight incisors protruded; in the vicinity of the teeth and particularly on the upper jaw, the gums were swollen, spongy and ulcer-

[1] Reported in full in American Medico-Surgical Bulletin, Feb. 1, 1894.

ated, and it was noticed that the breath was fetid. She lay in a bent attitude with the legs somewhat flexed, and made no attempt to move them. There was, however, motion at the joints, and when the soles were tickled the toes of both feet were moved, and the ankle on the left side; the knee reflexes were normal; there was a tender swelling of moderate size above the ankle, not involving the joint, and motions of and pressure on the lower limbs were especially painful, though the whole body was very sensitive to contact. The arms and head were moved naturally by the baby. The spine was abnormally rigid and somewhat bent, so that there was a distinct projection at the first and second lumbar vertebræ, as shown by the tracing (Fig. 1). The whole clinical picture was as distinct as

FIG. 1.

it was striking, but the fact that scorbutus was suspected was due to my having read Dr. Northrup's excellent paper[1] on the subject. The diagnosis was made positive the same day by my friend Dr. J. Henry Fruitnight, whom I called in council. The mother was directed to place the baby on a cot and on no account to move her, and the baby was at once put on a diet of pasteurized milk and fed every three hours; she also received the juice of an orange and two teaspoonfuls of raw beef-juice daily; from barely tasting the milk, she took more and more, until in a day or two she took six ounces at

[1] New York Medical Journal, December 12, 1891.

each feeding, and this had soon to be increased, as it failed to satisfy her; the beef-juice and orange, especially the orange, she took greedily from the start. No drugs were exhibited, except an occasional dose of phosphate of soda as a laxative. The little sufferer began to gain at once: she became quieter and evidently experienced great relief for she slept soundly through the first night, something she had not done for six months. The fever abated one and a half degrees a day until it reached normal, and in a very few days she had lost her peevishness, the eruption began to fade and the gums to heal, and she commenced to use her legs. Within three weeks the spine became straight and flexible, the swelling above the ankle had subsided, the baby was able to sit up and to move the legs freely, and, her general condition being satisfactory and all symptoms having disappeared, she returned home soon after, and was well when last heard from, a short time ago.

The parents of my patient report that a neighbor's child that had been brought up on the same brand of condensed milk was apparently healthy and well-nourished till the age of eleven months, when painful swellings made their appearance near the joints of the lower limbs; the legs lay motionless and helpless, and the child was in great distress, especially when moved. The gums were dark and swollen, and were said to have bled. This infant died exhausted in about two months.

Of the many practical points suggested by these observations, but two or three call for special mention at this time. The cause of the disorder is clearly to be found in the diet, and condensed milk must be added to the long list of infant foods that may prove dangerous. The parents were well-to-do people, and infants of this class seem more liable to this disorder than those of the poor. This may be due to the fact that the latter are more liable to get fresh vegetables from the table, and are less likely to get the artificial foods. It should not be overlooked that when a baby that has been sitting up normally ceases to do so, or when a child fails to sit up at the proper age, the cause should be searched out. The inability to sit properly was the first symptom to attract attention in my case. The peevishness, restlessness, and general and local suffering are important symptoms, due, no doubt, in part to the blood and tissue changes, and partly to local, bloody, and serous

infiltration or effusion, and particularly to hemorrhages beneath the periosteum of the bones of the lower extremities, the ribs, thorax, pelvis, and skull, which have been found post-mortem. The pseudo-paralysis is one of the most striking of the group of characteristic lower-limb symptoms in these cases; the trunk and upper extremities may also be affected. Inability to sit up and varying degrees of helplessness are frequently mentioned in the histories of scorbutus in infants. Taking cases of two years and under, we find in the histories such expressions as the following:[1] "Immobility of right lower limb;" "scarcely moves any part of the body except head;" "right arm drops as if paralyzed;" "legs hung down in a helpless fashion;" "lower limbs moved voluntarily very little;" "drew up its left leg; as for the right, it moves it slowly, but only a little, and could not be induced to flex it;" "right leg semi-flexed and everted;" "the legs were partially flexed and remained rigid." The limbs and trunk usually lie motionless, as if powerless, and the baby makes no attempt to change its position. The head and arms usually can be moved, and even in the affected members there are commonly certain movements that can be executed with more or less difficulty, but even handling, which caused acute suffering, and tickling of the soles failed to evoke in my patient the smallest movement of the knees, hips, or trunk.

As certain members can be moved, the pseudo-paresis cannot be wholly due to the prostration of the patient, though this and the disinclination to effort of any kind characteristic of the scorbutic state doubtless intensify the condition; neither is it to be entirely explained by the local hemorrhagic lesions, for while there was at the time of examination evidence of but one such lesion in my case, namely, that near the right ankle, the entire left leg, except the foot, was perfectly motionless. Just as little can we assume any essential paralysis, for the knee-jerks were normal, and recovery took place in a few days. I ask, therefore, if the bloody and serous infiltration into and between the muscles, and also the probable loose and succulent condition of the deeper layers of the periosteum, determining the site of the characteristic swellings, may not give rise to the bent attitude and pseudo-paralysis, since the contraction of the

[1] Thomas Barlow Keating: Cyclopedia of the Diseases of Children, vol. ii. Dr. W. B. Northrop: New York Medical Journal, December 12, 1894.

injured muscles and traction on their tender periosteal insertions would be instinctively avoided? In other words, is movement inhibited by the sensitive and damaged condition of the muscles and their insertions, or must malnutrition of the nerve-centres from impoverishment or toxicity of the blood be assumed? Where joint irritation exists there would be local reflex muscular rigidity, which could also operate to prevent motion, as would also peri-articular and intra-articular swellings.

This pseudo-paralysis is easily distinguished from other infantile paralytic affections by the hyperæsthesia and accompanying symptoms of the scorbutic dyscrasia, by the normal knee-jerks, and by its speedy subsidence on antiscorbutic diet. A somewhat analogous condition is the pseudo-paralysis of rickets, so well described by Dr. H. Berg. As scorbutus may coëxist with rickets, and may also be mistaken for it, it would be well to have the symptoms of scorbutus in mind when cases of the supposed rhachitic pseudo-paralysis come up for consideration. The scorbutic swellings due to sub-periosteal hemorrhage are frequently mistaken for acute rheumatism, and might be confounded with periostitis, acute abscesses of the hip, thigh, or ankle, and acute arthritis, but differ from all these affections in the absence of local elevation of temperature. Certain cases like my own might easily be mistaken for spondylitis. It also seems not improbable to the writer that some of the obscure cases of infantile malnutrition, with weakness, inability to sit up, bowing of the spine, and perhaps low fever, oftener due to chronic intestinal inflammation or to rickets, may be masked or incipient forms of scorbutus.

At a recent discussion on infantile scurvy, at the New York Academy of Medicine,[1] where over seventy cases were reported, Dr. L. Emmett Holt related four cases occurring in his practice the preceding summer. Of these, one with a large swelling about the knee was diagnosticated as sarcoma by several surgeons; the autopsy showed very extensive hemorrhage and epiphyseal separation at the lower end of the femur. Another case was diagnosticated tubercular osteitis of the knee, and was put up in a plaster splint in one of our largest hospitals. In another the diagnosis of infan-

[1] American Medico-Surgical Bulletin, March 15, 1894.

tile paralysis was made by a country practitioner. My friend, Dr. Dillon Brown, has drawn my attention to two recent papers of Howard Marsh, in one of which (*Lancet*, September 30, 1893) he mentions among the rare spinal affections the bowing, with exquisite tenderness, due to "scurvy-rickets." In the other paper (*Practitioner*, June, 1893) he mentions two cases in young children, in whom scurvy, attended with swelling in the gluteal region, was at first regarded as hip disease.

As I have been able to find no other reference in orthopedic literature to infantile scurvy, or the danger of mistaking it for joint or spinal affections, it has seemed proper to bring the subject before this association.

The peculiar combination of symptoms so clearly pointed out by Thomas Barlow—namely, the lower-limb symptoms, including the pseudo-rheumatic and pseudo-paralytic manifestations, the turgid and spongy gums, and especially the rapid improvement on anti-scorbutic diet, are both striking and characteristic. To this symptom-picture may be added peevishness, hyperæsthesia, and cachexia, but even if some of these symptoms are lacking, a correct differentiation from joint disease or paralytic affections should not prove difficult.

DISCUSSION.

Dr. Ketch thought the Association should be thankful to Dr. Taylor for his clear description of the disease. He could easily see how it might be confounded with rickets, and, indeed, he believed Dr. Jacobi considered scurvy to be a part of rickets. He had, himself, read a paper at the Academy of Medicine on "Pseudo-Rhachitic Paralysis." He would now probably call it one of scurvy-rickets, but the child had all the usual joint-symptoms of rhachitis.

Dr. A. J. Gillette said he wished to report a case showing a scurvy history. It was one seen in hospital, and had already passed through the hands of many medical officers before he had seen it. In this case all the joints of the upper and lower extremity were enlarged and contracted. The individual joints

resembled tuberculosis very closely, and there were also many appearances pointing to syphilis. By a process of exclusion the diagnosis of scurvy had been made, and improvement had been quite rapid under anti-scorbutic treatment.

Dr. Shaffer said that about one month ago he had seen, in consultation, an interesting case where the diagnosis lay between scurvy, rickets, chronic spondylitis, and rheumatism. The patient was a child of a few months, plainly sensitive to all movements. The attending physician, a prominent and able physician, looked upon it as a case of rickets. The differential diagnosis between scurvy and rickets seemed to depend largely upon the typical swelling and the condition of the gums. The child referred to not only had pain on movement, but on being made to sit up there would be the typical grunting respiration of Pott's disease in the dorsal region. The diet had been good, but assimilation had been defective. The case was regarded at the time as one of scurvy rather than as one of rickets, and it had already shown decided improvement.

Dr. Ryan said he wished to thank Dr. Taylor for his valuable paper. Some time ago his attention had been called almost daily to the scorbutic diathesis in the children in the Hospital for Ruptured and Crippled. He had not at that time recognized any bone lesions due to scorbutus. It was possible that scorbutus might have been the cause of certain evanescent joint troubles that had come under his observation.

Dr. Taylor said, regarding the case of large tumor about the knee, that owing to the great size of the swelling in this particular case it would not have been easy to mistake it for rheumatism, but in very many other cases where the swellings were not so great the diagnosis of rheumatism was commonly made. Infantile scorbutus had formerly been known under the name of "acute rickets," but Dr. Potts, of Halle, who had seen twenty-two thousand cases of children's diseases, one-third of them rickets, had stated that not one of them showed the symptoms of scurvy. He thought the consensus of opinion now was that the two affections were entirely distinct, though they might coexist.

TUBERCULAR DISEASE OF THE SHOULDER-JOINT.

By W. R. TOWNSEND, M.D.,
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Tubercular disease of the shoulder as compared with tubercular disease of the other large joints is a rare affection. The rôle that traumatisms play in the development of these conditions may partially account for its rarity, but the anatomical reason is not perfectly clear why the head of the humerus should be so seldom diseased as compared with the head of the femur. From its construction the joint is well protected; but traumatisms do occur, yet are seldom followed by disease.

The relative frequency is variously given. Crocq, quoted by Ollier, saw one case in 140. Billroth, out of 1996 cases of joint tuberculosis, had 28 examples in which the shoulder-joint was involved. Hubbard quotes the *Guy's Hospital Reports* as giving less than one per cent. of disease of the shoulder as compared with affections of the other joints. At the Hospital for the Relief of the Ruptured and Crippled, New York, from 1889 to 1893 inclusive, 3244 cases of bone and joint tuberculosis were noted, and of this number 21 were of the shoulder-joint.

Of these twenty-one cases, eleven were males and ten females. The average age at the time of the first visit was twelve years, the youngest patient being three and a quarter years, the oldest thirty-five years; ten were under ten years of age, seven from ten to twenty years, and four were over twenty. The disease had existed on an average one and three-quarter years, the longest duration being ten years, the shortest three months, showing as the average age when the disease first appeared to be about ten years.

These statistics are very different from those of Mondan and Audry,[1] who gave the average age as twenty-four years and seven

[1] Mondan et Audry les Tuberculosis de l'Epaule. Rév. de Chirurgie, 1892.

months, but thinks this is too high, and that twenty-three years would be more nearly correct. Their oldest patient was sixty, and the disease began at the age of fifty-five, their youngest eight years. They conclude the disease is less common in early than in adult life, but our figures would prove the contrary. Their figures do not necessarily prove this, because they only admit adults to their clinic; but at the Hospital for Ruptured and Crippled no distinction is made as to age.

In adult life, as in childhood, most cases know of no cause for the disease; and in the cases forming the basis of this paper in only two was a cause given, and in each instance a fall on the joint had preceded the disease. In five of these cases there existed tubercular lesions of other joints; one had Pott's disease, two had hip-disease, and two had disease of the knee; but in every instance the shoulder was the last joint affected. In the cases of Mondan and Audry ten out of forty had had hæmoptyses or other signs of pulmonary tuberculosis, and two had disease of other joints in addition to the shoulder.

The etiology of the disease is indicated by the title, and, as in most other forms of joint tuberculosis, the primary lesion in the body is more apt to be in the glands about the bronchi or lungs, or in the latter, than in the synovial tissues or bone. At least this is the generally accepted opinion to-day. The bacilli of tuberculosis are the primary cause of the disease; secondarily, traumatisms may have an influence, or may render a joint less able to resist the tubercular process. Heredity is no longer considered a potent factor.

The pathology does not vary from that of tubercular disease of other joints, and as the results of thirty-two excisions practised by Ollier and his colleagues, all done on adults or patients near adult life, in their valuable article on the subject, Mondan and Audry report the following:

The starting point of the disease was in twenty-nine cases in the bone, in one doubtful, and in three it was clearly synovial. Of these cases in twenty-three the disease originated in the humerus, in four in both the scapula and the humerus, and in one in the scapula. In ten patients there was one lesion in the humerus, in nineteen the lesions were multiple. In twenty-two cases it was in

the epiphysis, juxta-epiphyseal in five, and both in the other five. The anatomical head and neck were the sites in twenty-six, twelve in the neck and fourteen in the head of the bone.

The disease was as a rule peripheral rather than central, and was generally just beneath the cartilage, and several ill-defined cheesy masses were generally found; rarely was a distinct well-defined focus seen. In addition to these cheesy masses in twelve excisions sequestra were found, seven of the humerus, four of the scapula, and one of doubtful origin. In these cases the bone may be very hard and different from most sequestra found in necrosis from ordinary causes. A condition exists which Ollier speaks of as "para tuberculose," really a new process, the result of the inflammation. In one of his cases the sequestrum had probably been in the joint for eleven years, yet the edges were very little softened. In the three cases reported in this paper in all the focus was situated in the head of the humerus.

The symptoms of the disease come on as a rule very slowly, although they may come on rapidly, abscesses occur, and destruction of the joint follows with more or less complete ankylosis. In childhood the symptoms come on as a rule more slowly than in adult life, and are less apt to be severe and terminate in abscess.

The symptoms in disease of the shoulder are constitutional and local. The former are those common to tubercular inflammations, and usually only consist of a slight or moderate change in the temperature, a slight elevation in the evening, with a return to the normal or nearly to it in the morning. Of course, where general tuberculosis is present the constitutional symptoms are more marked. In slight cases they may be entirely absent.

The symptoms referable to the diseased articulation are pain, reflex spasm, atrophy, change in the contour of the parts, loss of function, glandular enlargements usually in axilla, shortening of the arm, abscesses and ankylosis.

The pain is usually the first symptom noted, and may vary greatly. In some it is only present when joint motions are made, and occasionally even only when the motions are severe and excessive. Again, it may be much worse at night than by day, and elicited only by deep pressure or by the slightest touch. It is usually referred to the shoulder-joint, but may be complained of at

the elbow or in the muscles in front of or behind the joint. In some rare instances the disease may progress steadily, and only a sense of fatigue be complained of after using the limb. In the majority of cases, however, the pain is a serious symptom, is usually worse at night, and may require the use of anodynes for its relief. In one instance reported by Ollier an excision was performed simply for the relief of a most violent and intractable pain in the joint.

In this joint, as in all others affected by chronic disease, reflex muscular spasm is the most important symptom. Whenever present it is a positive sign of disease. It appears early and remains throughout. The spasm is most marked in the deltoid, and is most easily elicited by abduction of the arm. As the circumflex nerve supplies both this muscle and the joint, movements of flexion and extension, in both of which fibres of the deltoid also come into play, are limited by spasm as soon as abduction is made. Adduction and rotation are less apt to be painful and limited by spasm; but as the joint is supplied by the same nerves which supply the muscles about it, in well-marked cases all motions are limited.

The atrophy is an early symptom, and is most marked in the deltoid; the wasting may be very rapid and extreme, suggestive even of paralysis. All the muscles about the joint decrease in size, even those posteriorly on the scapula and in front on the arm and forearm. Cases have been reported also of atrophy of the pectorals. The length of the humerus is affected, and in a case reported in this paper the forearm was also shortened. In all cases examined the length of the arm on the affected side was shorter than the healthy limb. This shortening varies from a quarter of an inch to several inches. No change has been noted in the hands, but it is reasonable to suppose that they might also be smaller. Disuse later on helps to increase the atrophy. If the upper epiphysis of the humerus has been removed before ossification is complete the shortening might be excessive; but I have not had the opportunity of measuring any such case or finding the record of one. Nor have I found notes of any case where the atrophy by diminishing the support to the joint has permitted a dislocation to occur.

As a result of the atrophy we have marked changes in the

contour of the parts about the joint. By diminishing the size of muscles the bony prominences are more clearly brought out. The acromium projects, a depression is seen beneath it, the coracoid may be made visible, and the head of the humerus be seen in front of the joint. The paralysis of the deltoid weakens the support about the articulation, and even where no fluid is present, the humeral head may be lowered, the weight of the arm pulling it away from the glenoid cavity.

Secondary effects may be produced which also change the contour of the parts. The sternal end of the clavicle may be more or less completely dislocated upward from a pulling down of its acromial end, and a lateral curvature of the spine result from a change at the shoulder. Looked at posteriorly the atrophy of the scapular muscles bring into prominence this bone, and when ankylosis has occurred displacement of the scapula also results, and its inner angle is made more prominent.

The loss of function, due to muscular spasm primarily, and later on to ankylosis, varies greatly. It may be most limited when due to spasm, for the pain and fear of pain will hinder free motion. Abduction is most affected, then flexion and extension, lastly adduction and rotation. Circumduction being due to a combination of the others is entirely suspended. After ankylosis has occurred the mobility of the scapula, which mobility is in such cases increased, renders the loss of function less than it otherwise would be. In examining patients who have had this disease we must test the motions of the arm and shoulder-joint separately and distinct from those of the forearm. Many have good use of the forearm and no disability so long as motions of abduction of the arm are not undertaken, yet their disability is complete in that particular.

Ankylosis partial or complete is the usual termination of the disease. Partial ankylosis is generally fibrous in character, and complete ankylosis bony. As a rule this union of the humeral head to the glenoid cavity limits the ability to raise the arm from the side to about one-third or one-fourth the normal. Raising the arm above the horizontal or beyond 90° is accomplished by the trapezius, and is usually impossible when ankylosis exists; by the power of the trapezius and the mobility of the scapula, however,

in some the arm may be raised to the horizontal, and the fact diminishes somewhat the disability. All movements requiring great freedom of the arm are therefore seriously interfered with. The patients are often unable to raise the hand to the mouth or head, thus rendering them incapable of feeding or properly dressing themselves. They may or may not be able to lift much even with the arm extended, and the power to hold up much weight when the arm is abducted is in all cases very much diminished.

The loss of function is thus seen to be a serious matter in many cases, and only such work can be done in severe cases as requires but little force and such as can be supplied by the forearm alone. When the patients can get the hand to the head to feed and dress themselves the condition is not so serious, and the disability often but little felt.

In most cases of tubercular disease of the shoulder abscesses occur sooner or later. Mondan and Audry found them in twenty-seven out of thirty-three patients. In all but one of the cases we have seen of many years' standing abscesses either had existed or were present. They generally appear in front of the joint or below in the axilla. They may burrow down and appear upon the arm, or on the chest, and in a case reported by Panas the abscess first came to the surface below the elbow. With the appearance of the abscess the joint may appear swollen, and the increased size of the joint is more often due to this cause than to distention by synovial fluid. The abscesses rarely heal promptly, but leave sinuses which discharge for a varying number of months or years. In one of our cases the sinus has been discharging for two years. They may close and reopen a number of times before a final cure results.

The duration of the disease varies, but we may safely say that two or three years in favorable cases would nearly represent the average, and a much longer time in the unfavorable. A not infrequent occurrence is to have the symptoms subside, and then, either due to a traumatism or from some unknown cause, an exacerbation occurs and the symptoms may be very acute. Many such cases, save for the occurrence of abscess and other symptoms, would almost lead us to believe they were rheumatic. Relapses in perfectly cured cases however are rare.

From the close proximity of the glands in the axilla to the joint the former are usually enlarged when tuberculosis exists. The enlargements may subside with the disease, or they may become cheesy, or break down. They usually call for no local treatment.

The complications of the disease are those common to tubercular joint troubles, the most common being the involvement of another joint; but in our cases the shoulder was always the second, never the first, where the patient had several lesions. From its close proximity to the lungs pulmonary complications are frequent in adults. In children we cannot speak positively on the subject. But as the bone lesion is rarely the primary one, the exact influence it may have on the production of the complications is not always perfectly clear or easy to estimate.

The differential diagnosis is a matter of great importance, and in typical cases is usually easy. The conditions most often mistaken for tubercular disease of the shoulder are rheumatic arthritis, paralysis of the deltoid from any cause, dislocation of the humerus, and osteomyelitis of the upper portion of the humerus.

In rheumatic arthritis in early life the frequency of occurrence of tubercular disease is important, as monarticular rheumatism is comparatively rare, the rheumatic affections generally being found in several joints, and may be accompanied with chorea and heart lesions. In rheumatic arthritis of adults there is usually a history of rheumatic pains in other joints as well as in the joint affected. In tubercular joint disease the onset is slow and insidious, in rheumatic arthritis more apt to be rapid and well marked. In tubercular disease of shoulder atrophy is an early symptom; in rheumatic disease the parts in and about the joint are swollen. Reflex muscular spasm is present in both, but most marked in the tubercular cases. Glandular enlargements are common in the tubercular; rare in the rheumatic. The length of the humerus and of the arm is shortened in the tubercular; unchanged in the rheumatic. The presence of pulmonary or other tubercular lesions may occasionally be of assistance in making a diagnosis. In tubercular disease the pain is usually worse at night; in rheumatic cases the contrary is the rule. Rest and support may relieve the symptoms in the tubercular; usually do not in the rheumatic. The so-called anti-rheumatic drugs may soon cure the rheumatic; generally have

no effect on the tubercular. Abscesses are common in tuberculosis; rare in rheumatism. Constitutional symptoms generally more marked in inflammatory rheumatism than in joint tuberculosis. A careful study of the history and of the above-mentioned differences in symptoms usually makes the diagnosis an easy matter.

From paralyses of either central or peripheral origin, the history, the character of the attack, the electrical examination, the absence of glandular enlargements and of abscesses, the lack of pain, the loose or flail joint as compared with the one held rigid by muscular spasm or ankylosis, should make mistakes between these two diseases almost impossible.

A careful anatomical examination, the disability following immediately after a fall, absence of reflex spasm and other symptoms of joint disease, ought easily to exclude dislocation of the humerus.

In osteomyelitis the history, rapid onset, severe constitutional symptoms, swelling instead of atrophy, and careful examination of the affected bone will rarely cause any doubt as to the true nature of the lesion we have to deal with.

The prognosis of the disease should be considered from two standpoints, the effect on the general constitution and locally on the joint. On the general health it is doubtful if disease of the shoulder is more serious than disease of the other large joints; a certain number of patients die from tubercular meningitis or pulmonary complications, but it is very difficult to say in most cases that the cause of death may not have been from an infection of tubercular material from some other source than the diseased shoulder. In adults, if abscesses have formed and sepsis occurred this may cause death; but in childhood such an occurrence is rare, The prognosis is worse in adults than in children, for bone tuberculosis is more apt to terminate favorably in the latter, and the complications are less frequent. On the joint itself the prognosis is bad. Many cases end in ankylosis and practical destruction of the articulation, others have more or less firm ankylosis without much destruction of bone, and but very rarely is a good functional result found.

The slow and insidious onset of this disease and the fact that it

is so often mistaken for a rheumatic affection, and little attention therefore paid to it, account for the statement previously made, that in twenty-one cases seen by the author the disease had existed on an average one and three-quarter years before treatment was begun. This fact must also be taken into account when we consider the results, for the majority already had ankylosis either partial or complete when first seen. A few cases were seen early and conservative treatment advised, but this was so poorly carried out that in no case can we say that mechanical treatment was really given a fair trial; but careful reading and the examination of some patients who it may be supposed had been subjected to careful mechanical treatment lead to the belief that ankylosis more or less complete is the usual result after such treatment. Two methods are available, one simply to keep the joint at rest by plaster-of-Paris or silicate-of-soda bandage, or less efficiently by a simple sling, or in the second method to immobolize the joint and make extension by adhesive strips applied to the arm, the counter pressure being by a crutch in the axilla. To put the patient in bed and make traction by weight and pulley would not recommend itself to many. In all the cases treated by immobilization the pain and spasm were relieved by the support. In Cases IV. and V. of this paper the early treatment was improper and of a nature to produce ankylosis. The fallacy that complete immobilization of tubercular joints produces ankylosis is a theory of the past. That motion at the shoulder may occasionally be secured by *brisement forcé* in the rheumatic is not under consideration, but in tubercular disease of the shoulder all agree that joint motion should be prevented. After the acute symptoms have subsided electricity may be used to stimulate the muscles, but massage should not be employed in and about the joint for fear of starting up the disease again. Any violent motion active or passive is to be avoided.

The question of operation in disease of the shoulder-joint has until very recently been much influenced by the fact that excision has been considered a very dangerous procedure. The statistics of Gurlt, Otis, and Culbertson have been quoted by all writers on the subject, but we must remember they were all made before the days of aseptic and antiseptic surgery, and have really very little value

now. Even the statistics of Sack[1] and König[2], made in 1880, would be no doubt improved were they to report again to-day. In considering the subject of an operation several questions must be asked and answered.

1. Are operations on the shoulder justifiable in early life?
2. If so, what should be the operation?
3. What are the dangers of the operation?
4. Should adults be subjected to operative rather than mechanical treatment?
5. Should operation be undertaken on patients suffering from general tuberculosis?

In answer to the first question we will say that as the growth of the humerus is largely from the upper epiphysis, to remove this by a complete excision before the eighteenth year would much shorten the arm, and in only exceptional cases would such an operation be justifiable. Operations that do not remove too much tissue, and thus prevent growth, are justifiable, and may, by completely removing all the tubercular disease, stop its progress and leave a useful joint. By partial excisions we should have a small mortality list, and this should especially be the case when the operation consists simply in the removal of part of the head of the humerus. The statement of Culbertson,[3] quoted by Bradford and Lovett,[4] that partial excisions are more dangerous than total, is misleading. The nearer we approach the trunk the greater the danger, is true, and to remove half an inch of the scapula is more serious than to remove six inches of the humerus. We should, therefore, if possible, confine our operations to the latter bone. In fact, very few typical excisions of the shoulder are done, either on children or adults, the rule being only to remove the diseased tissue and endeavor to get a movable joint as the result.

The dangers of the operation are sepsis and death and the dissemination of the tubercular material with the production of tubercular meningitis or pulmonary tuberculosis. The danger from sepsis is still present despite improved technique, but with

[1] Beitrage zur Statistik der Kniegelenresection bei Antisept. Behand. Dorpat, 1880.
[2] König, Archiv. fur Klinische Chirurgie, 1880.
[3] Transactions American Medical Association, 1876.
[4] Bradford and Lovett's Orthopedic Surgery, 1890.

proper precautions should be very small and not deter us from operating. The same is true of the danger of producing tubercular meningitis, although in one of the cases here reported a death followed from this complication. The danger is a real one, but just how often meningitis occurs after operations on tubercular patients it is impossible to say. The statement of König, for instance, that in eighteen cases of acute tuberculosis in his practice sixteen followed operation, is of value; but we ought to know how many cases of acute tuberculosis had developed in those with joint symptoms in whom no operation had been done before we conclude that the percentage of such complications is really large. Cheyne, in the *Lancet* for 1890, reports two cases similar to the one reported in this paper; and it would be very interesting to know if such a complication is more frequent after operations on the shoulder-joint than after operations on other joints of the body.

That these complications do occur would seem to be an argument against operations simply for the sake of preventing general tuberculosis, as some have advised.

In adults the question differs somewhat from than in childhood, for the tendency to pulmonary complications seems greater, and drain from long-continued suppuration is, as a rule, much more serious in its results. The general advice then would be to remove the disease as early as possible in adults. If a partial operation can be done so much the better. Many such cases are reported, a very interesting one on a boy of fourteen having been done by Davies Colley,[1] in Guy's Hospital, where a part of the humeral head, the great tuberosity and adjoining articular surface were removed, and a perfect functional result followed.

Several inches of bone may be removed and the result be very satisfactory, as in the case reported by Hubbard,[2] where he removed four inches of the humerus, and one and a half years later there was only one and a half inches of shortening of the arm. The functienal result was almost perfect.

Whether the operation be partial or complete, the sub-periosteal method as devised by Ollier should be followed; the growth of the bone is permitted even after the removal of much tissue, and the

[1] Guy's Hospital Reports, 1871.
[2] Medical News, April 24, 1886.

wonderful results he reports in some cases could certainly not be duplicated by any other method of operation. In one case after complete removal of the head of the humerus a new head was formed, and drawings are shown of the portion removed and of the reproduced bone at the end of nine years.[1] In children operate early, but do not remove the epiphysis and thus prevent growth of the limb.

In general operations should not be undertaken where pulmonary tuberculosis is also present; but in some cases the improvement after operation is most marked, Ollier mentioning several where the hæmoptysis was entirely stopped or much decreased after an excision. In endeavoring to decide whether to subject such patients to operations we should as far as possible be guided by the fact whether the local condition or the constitutional one seems most responsible for the symptoms—never a very easy question to decide, but when the shoulder is suppurating freely, is very painful, and the pulmonary symptoms slight, operations may be undertaken with a hope of relieving both the local and the constitutional signs.

The principal reason for advocating operative rather than mechanical treatment is that ankylosis more or less complete is the usual result after the latter, and in the arm freedom of movement is what we need; and after partial or complete excisions this result may be obtained in most cases. The question is different at the hip and shoulder. At the hip after excision we want a firm support; ankylosis is preferable to a flail joint. A shortened leg greatly interferes with locomotion; but an arm slightly shortened and freely movable is preferable to a stiff one, although it may be several inches longer; and partial operations do not much diminish the length of the arm. We do not believe operations on the shoulder dangerous, as we reject the old statistics of pre-antiseptic days. The joint is easy of approach, and in a large majority of instances the disease is located in the head of the humerus, and can thus be entirely removed. By partial operations and the subperiosteal method the growth of the limb should not be much affected.

In looking over the literature of the subject for the past few

[1] Ollier, Traité des Excisions, tome i, p. 350.

years I have found only one case of tubercular shoulder-joint disease reported by an American, and that was by Nathan Jacobsen,[1] of a boy aged three-and-a-half years, who had disease of the left shoulder. In this case an incision was made from the anatomical to the surgical neck, all the diseased bone removed by a Volkmann spoon, leaving an opening through the entire thickness of the bone large enough to admit the index finger. Recovery was slow, but the result almost perfect, there being a half inch shortening and ability on the part of the patient to carry hand to the head, etc.

The histories of the following cases illustrate all types of the disease except those where the symptoms come on very rapidly and joint destruction soon occurs. No such case has come to our personal notice.

Case I.—*Disease of the Right Shoulder.* W. M., female, aged seven-and-a-half years, admitted to hospital May 23, 1890. Hygienic surroundings good. An aunt died of phthisis, otherwise family history negative. When three years old began to complain of pain in her shoulder, the arm became stiff, and has so remained. For the past three months the pain has been very bad. At the time of admission the left humerus was nine and a half inches long, the right eight and three-quarters. Over the shoulder, through the axilla on the right side was five and a half, on the left six and a quarter inches. The circumference of the right arm was six inches, of the left six and a quarter. The head of the humerus was held firmly in the glenoid cavity. No tenderness or pain present. No motion at the joint. The scapula and clavicle were normal. The arm hung by the side and could not be abducted. Elbow normal.

On May 24, 1890, under ether, an incision two inches long was made over the outer and anterior aspect of the joint down to the bone, and through the periosteum. This was retracted and a drill introduced at the upper part of the surgical neck, and made to pass into the head of the bone, which was found softened. This was thoroughly curetted, leaving only a small shell of bone, the major portion of the interior of the head being removed. The articular

[1] Med. Record, Sept. 20, 1890.

surface was not touched, and the joint not entered. While under ether, before the scraping was done, motions of the arm were found to be free and no grating in the joint. The wound was packed with iodoform gauze, a plaster-of-Paris bandage applied, the arm being close to the body, and the forearm at a right angle to the arm. The recovery was uneventful, and she was discharged from the hospital July 7, 1890. At that time there was no pain and very little if any motion in the joint.

Examination May 17, 1894. General condition of patient very good. The arms hang naturally by the side. She can raise the right arm above her head and within twenty degrees of the left. Can raise the arm rapidly and strongly to the horizontal, and uses both equally well. She can place the hand behind the back and in the opposite axilla, and uses it freely in jumping the rope, in which exercise circumduction comes into play.

The length of the right humerus is ten and a half inches, the left eleven and one-quarter inches; the length of the arm, forearm and hand from tip of acromion to tip of middle finger on the right side is twenty-three and a half inches, on the left twenty-five inches. The circumference of the right arm at axilla is six and three-quarter inches, of the left seven and a quarter inches. Over the shoulder and through the axilla on the right side is nine and a half inches, on the left ten and a half inches.

Case II. *Disease of the Right Shoulder and Right Hip.*—W. M., aged six-and-a-half years. Admitted to hospital January 3, 1894. Hygienic surroundings good; family history negative. Is wearing a brace on the hip. In February, 1893, it was noticed that he held the arm close to the side, and could only lift it to the horizontal position. All motions of the joint were painful. His general health was good; his appetite poor. He had night cry. In August he developed hip-disease. At that time the shoulder was fixed, no motions allowed, and no signs of abscess. There was one-inch atrophy of the upper arm.

January 20, 1894.—Patient is unable to move the arm. On the anterior aspect of the body midway between the acromion and the nipple is a fluctuating tumor the size of a walnut.

23*d.*—Incision is made over the anterior aspect of the shoulder-joint, periosteum divided and retracted, a drill intro-

duced, and the head found partially necrosed, and the glenoid cavity filled with gelatinous material but not diseased. The motions at the joint can be freely made. All the diseased bone and gelatinous material removed, and the abscess sac in and over the pectoralis major is thoroughly curetted and a counter opening made in the axilla for drainage. The wounds are packed with iodoform gauze, and by March 12th all the sinuses have healed.

May 25.—General condition good. Holds arm naturally by the side; can raise it half-way to the horizontal; can place the hand on his forehead and on opposite shoulder. There is no pain either on pressure or when he moves the arm.

From the tip of the acromion to the lower edge of the external condyle, on the right side, is six and a half inches, on the left seven and a quarter. From the tip of the acromion to the tip of the middle finger on the right side is sixteen and three-quarter inches, on the left seventeen and a half inches. There is half-inch atrophy of the arm and the same of the forearm. Flexion and extension of the arm about half the normal.

Case III. *Disease of the Right Shoulder.*—J. J., male, aged eleven years; admitted to hospital October 1, 1890. Mother and father both dead of phthisis. Duration of disease unknown. Has had plaster-of-Paris applied to the shoulder, and the pain has been relieved by day but not by night. The right shoulder is lower than the left; there is marked atrophy of the deltoid, and the acromion is prominent. There is marked muscular spasm, pain and tenderness. The lower angle of the right scapula is lower than that of the left. There is slight lateral curvature in the dorsal region, convexity to the left. The right arm from tip of acromion to tip of middle finger measures twenty-four and three-quarter inches, the left twenty-five and a quarter inches. The circumference of the right shoulder is twelve and a quarter inches, of the left eleven and a half inches. The circumference of the right arm is five and seven-eighths inches, of the left six and five-eighths inches; the right forearm six and a half inches, the left seven; the right wrist four and three-quarter inches, the left five inches.

October 6.—Under ether an incision was made two inches long over the head of the humerus. The head of the bone was found

softened and gouged out, and a drainage-tube put in. There was some gelatinous material in joint, which was also cleaned out; the glenoid was not diseased. The arm was dressed in abduction of about 20°.

29*th.*—A Knight spinal brace was applied, with a crutch for the right arm, the idea being to gradually raise the arm from the side.

November 15.—Patient is up and about the ward and improving nicely.

16*th.*—Complains of headache, nausea and vomiting.

17*th.*—Headache and vomiting increased. Bowels constipated. Pulse irregular. Photophobia. Irregular respirations. Retracted abdomen.

18*th.*—Irritable.

19*th.*—Less irritable. Headache; retracted abdomen.

20*th.*—Delirious. Examination with ophthalmoscope shows double optic neuritis.

The symptoms continued and death followed November 30th, or fifty-five days after the operation, from tubercular meningitis. Autopsy twenty-four hours later.

Brain. The sinuses filled with dark fluid clots, not adherent. The brain much congested; the convolutions slightly flattened. Scattered over its entire surface, but more abundant on the lateral surfaces, were a large number of miliary tubercles. On the base of the brain they were more abundant still, and the inter-peduncular spaces were studded with them. There was a small amount of lymph and pus present. The ventricles were not distended. The liver was fatty and a few miliary tubercles were scattered over its surface.

Chest. Over the left chest were numerous dense fibrinous adhesions of long standing.

Right Lung. At the apex was a small area of miliary tubercles surrounded by fibrous tissue; a few tubercles were scattered over its surface.

Left Lung. Studded at apex with cheesy nodules. The collection of nodules is surrounded by a layer of chronic interstitial pneumonia which has about it a considerable area of recent tubercles; these are also scattered throughout the lower lobe. The lung shows evidences of an old phthisis with recent extension.

The *bronchial glands* were not diseased.

One *kidney* was normal, the other had several tubercles on its surface and a drop of pus in the pelvis.

Heart. Normal.

Intestines. Moderately congested.

Mesenteric glands. Normal.

Stomach. Contracted; empty near the pylorus. On the greater curvature are several ulcers one-twelfth of an inch in diameter, with reddened edges.

This is a very interesting case, for the meningitis may have been due to the dissemination in the general system of tuberculous material at the time of the operation.

In all these cases the operations were done by Dr. Gibney.

CASE IV. *Disease of the Left Shoulder.*—L. L., female, aged twenty-four years. When fourteen years of age, in play, had her arm given a pull which caused her some pain, and was followed by lameness. She was examined at the time by Dr. Gibney, and found to have one-inch shortening, marked atrophy, pain on moving the joint and a grating crepitation. Use of the arm, however slight, aggravated the pain, and she complained of being unable to rest at night. The muscles about the joint reacted perfectly to the faradic current. A sling was employed without benefit. At the end of five months she was admitted to St. Luke's Hospital, and under ether the arm was freely moved in all directions. After this passive motion was resorted to daily, and the failure to derive the benefit expected was attributed to the lack of vigor in carrying out the after-treatment and her desire to get home. In May, 1884, she could abduct the arm to an angle of 135° (about half normal), there was little rotation and very little tenderness. There was one and three-quarter inches atrophy of the arm, and one inch shortening. In 1892 she had an abscess in front of the joint, which was opened, and the sinus still discharges. In 1893 she had another abscess, and the same plan followed, with the same result.

May 17, 1894.—General health fair. Has two discharging sinuses. Has no cough or symptoms of general tuberculosis. Works daily in a card factory, and feeds a press with the left arm. The work really requires no motion at the shoulder, but is all done with the forearm. She can raise the arm half-way to the hori-

zontal, and can get the hand nearly to the median line of the back. Can place it on her head and on the opposite shoulder. There is marked atrophy of the parts about the shoulder. The circumference of the right arm is ten inches, of the left eight inches. From the tip of the acromion to the lower edge of the extended condyle of the humerus is ten and three-quarter inches on the right side, and nine inches on the left. From the tip of the acromion to the tip of the middle finger, on the right side, is twenty-five inches, on the left twenty-five and a quarter inches. She has occasional pains in the shoulder, but no serious trouble.

CASE V. *Disease of the Right Shoulder.*—F. W., female, aged twenty-five years. The disease came on slowly, and there was no cause given; but from childhood the arm had been weak. Since 1880 she has been unable to get the hand to the head. In 1888 she had an abscess form in front of the joint, which discharged for five weeks, then healed. Has had none since. Her early treatment, as described by Gibney,[1] was "active and passive motion, emollients, and electricity. These means failing, forcible movements under ether; subsequently passive motion, restiffening of shoulder," and the further note added "seems to improve when not treated."

March 11, 1893.—General condition good; weighs one hundred and thirty pounds; works all day as saleslady; thinks she can lift as much with right as with left arm; can do no motions where the deltoid is needed. The ankylosis is complete, yet can place the hand on the head, but lowers the head a trifle in so doing. Can place hand on the opposite shoulder with the arm close to the body. Cannot move the arm more than three inches from the body as measured at the elbow. The right arm, measured from the tip of the acromion to the tip of the middle finger, is twenty-six inches long, the left twenty-seven inches. The circumference of the right arm is nine inches, of the left ten inches; of the right forearm eight and a quarter inches; of the left eight and a half inches.

CASE VI. *Disease of the Right Shoulder and Right Knee.*—A. W., female, aged twelve years. Seen at hospital April 19, 1892.

[1] Case I., Gibney. Chronic Disease of the Shoulder, etc., Medical News, 1886. Case IV. is No. 2 of same paper.

Family history negative. The knee-disease began when she was two years old, the shoulder when eight. She had marked atrophy of the shoulder, moderate spasm, and partial ankylosis. Had pain at night in the shoulder. A sling was recommended, but never worn.

May 15, 1894.—General condition good. No signs of abscess. No joint tenderness. Can place the hand on top of the head and behind the back, but cannot raise the arm to a horizontal position. Joint is painful on pressure, and she does not use it with the same freedom as the left. There is one-inch atrophy of the arm, and two inches shortening as measured from the tip of the acromion to the tip of middle finger.

CASE VII. *Disease of the Right Shoulder and Lumbar Pott's Disease.*—E. B., male, aged twenty-two years. Seen at hospital July 15, 1893. When eleven years of age had Pott's disease, and at fifteen, without any known cause, noticed his right shoulder was getting stiff; this continued until he was unable to move it; but does not know the exact time, but it was several years. The pain was slight and always worse at night. The arm has ever since been much weaker than the other. Never had any treatment.

May 15, 1894.—General condition fair. Is wearing a Knight spinal brace. Acts as a messenger boy. The right shoulder very much atrophied and slightly higher than the left. The lower border of the right scapula about one and a half inches higher than the same border of the left. The right arm from tip of the acromion to tip of the middle finger is twenty-six inches, the left twenty-seven inches. The right humerus is ten inches in length, the left ten and a half inches; the right forearm eight and a half inches, the left nine inches. The glands in the axilla are much enlarged, but he has never had an abscess. The sternal end of the right clavicle is partially dislocated upward. He can put the hand to the mouth, but not on top of the head. Can separate the elbow from the body three inches. The arm is very weak, and he uses it but little. Never has pain, and there is no joint tenderness. The ankylosis seems bony and firm.

DISCUSSION.

Dr. Ketch said he had listened to the paper with great pleasure. The comparative rarity of shoulder-joint disease had been frequently referred to in surgical literature.

Many years ago Dr. A. B. Judson had written a paper in which it was suggested that this comparative infrequency of shoulder-joint disease was due to the peculiarity of the supply of the shoulder-joint and the infrequency of traumatism to which it was exposed. He could not present any statistics at present, but he thought he was correct in stating that by mechanical treatment quite a number of cases of shoulder-joint disease at the New York Orthopedic Dispensary had resulted in a better condition than had been indicated in the paper. He saw no more reason for operating in tubercular disease of the shoulder-joint in children than in tubercular disease of the other joints. In a general way it was well to avoid excision in children.

Dr. Shaffer said that in his mechanical treatment of shoulder-joint disease he had used a small crutch under the arm, and a simple traction brace, and had seen some very satisfactory results from this method. He had seen the traction apparatus secure most excellent results even in suppurative cases in adults. He would, therefore, hesitate a long time before recommending operative treatment. He had at present under his care a lady suffering from shoulder-joint disease of traumatic origin. Dr. W. T. Bull had seen the case in consultation with him, with a view to deciding whether operation was advisable. It was decided not to operate then. This was last February. Under the influence of massage and mechanical treatment she could already get the arm up to the head very nicely. In this patient there was nothing to indicate tuberculosis. He knew of a gentleman whose shoulder had been suddenly cured by a blow received on the shoulder, resulting in breaking up the adhesions. The shoulder-joint seemed to bear such treatment very well.

Dr. Ryan said that the paper opened up the old subject of any joint. He agreed with Dr. Ketch that there was no reason for excising the shoulder-joint any more than any other joint. He had understood the author to advocate operative treatment solely. It seemed to him that we Americans were becoming infected with the German operating enthusiasm. Formerly the Germans drilled every joint, but now the tide had already changed, and they were beginning to avoid operative interference in all joints. From his limited experience in shoulder-joint disease, he was impressed with the fact that mechanical treatment yielded excellent results. Each case was a law unto itself, and the results naturally depended very largely upon the good judgment of the surgeon. It was quite probable that the freedom from traumatism explained the comparative infrequeney of shoulder-joint disease. He agreed with the author that the statistics of Culbertson had been rendered practically useless by the revolution which had taken place in surgery.

Dr. John Ridlon, of Chicago, said he agreed with those who had spoken in favor of mechanical treatment. He had not met with a case of shoulder-joint disease which could be properly controlled in the treatment which had not yielded a good result. His experience with the traction splint referred to by Dr. Shaffer, was not, however, as successful as immobilization without traction. He had found one or two cases where there was discomfort from the traction itself. His treatment had consisted in immobilizing the arm to the body, supporting the hand with a halter, and still further immobilizing the joint by means of adhesive plaster. The method was simple and inexpensive, and was effective. The only objection to it was that the patient when relieved of pain objected to going around with the appearance of having but one arm.

Dr. Townsend said that the case narrated presented the typical symptoms of shoulder-joint disease. The lesions were not in the synovia, but were intra-capsular. The element that traumatism played in the production of disease cannot be gainsaid. He was familiar with the paper of Dr. Judson. The best way to become

conservative, he thought, was to begin operating. He thought the greatest conservative would be eventually he who had been the most inveterate operator. In the shoulder and arm we desire not only a strong arm, but a movable and useful arm. Ankylosis was preferable in a hip to a limb dangling after excision; but at the shoulder we desire free motion. He did not deny that cases of shoulder-joint disease treated scientifically from the beginning to the end entirely by mechanical means might get well without bony ankylosis; yet the cases he had seen had had more or less ankylosis which had interfered greatly with the usefulness of the limb. He thought, therefore, that the operative treatment was capable of giving in the average case much better results than the purely mechanical treatment. For this reason, operation might be indicated at the shoulder-joint which would not be considered suitable in disease of the hip or other joint.

RHACHITIC DEFORMITIES.

Etiology, Clinical History, and Lesions.

By A. JACOBI, M.D.,
NEW YORK.

I rise with much diffidence, for I am to discuss a subject with which you are familiarized from day to day. You see these rhachitic deformities so frequently that I am afraid I shall repeat, from my point of view, things which are to you matters of daily observation and experience.

Our subject is the etiology and the lesions of rhachitic deformities. By way of introduction I would say that rhachitic deformities are something new in our country. You have seen so many of them that undoubtedly the younger men here do not remember the time when there were no rhachitic deformities amongst us. Thirty years ago there was no rhachitis, except very rarely a stray mild case. At that time, when I spoke of rhachitis and endeavored to demonstrate a case in my clinic, I had to hunt considerably for material to illustrate this condition. When, twenty-two years ago, I wrote a paper on the first cases of craniotabes I had seen in New York, it was, with the exception of one, by Parry, of Philadelphia, the first paper on this subject ever written in our country. The subject of rhachitis, therefore, is a comparatively novel one. Since that time immigration has been going on, and the poverty-stricken people from the slums of Europe have been accumulating here. As with the greater facilities for transportation science has been equalized all over the globe, so poverty, bad air, and want of every description have equally spread constitutional diseases here. Since then we have seen much rhachitis here. Thus it is that the treatment of rhachitis in the future, although it will always remain medical, will also be a social question.

The principal causes of rhachitic deformity are numerous—the rapid growth, the thick epiphyses, the soft diaphyses, the condition of the ossification cartilage, the traction of the muscles, the debility of the muscles, and the pressure of the atmosphere. The locality where the deformities are found depends largely upon the intensity of growth. Growth is most intense in the young child: (1) In the cranium; (2) in the chest; and lastly only in the extremities. I recapitulate only what you all know when I speak of the rhachitic head, with the thin skin, the dilated veins, and the open sutures and fontanelles for two, three, four, or even nine years, as I have seen it. The edges of the sutures are irregular. Such a head is usually large—actually larger than the normal head—relatively it is very much larger when compared with the frequently small body. It is so large that it resembles sometimes the hydrocephalic head. Indeed, some of these heads are to a certain degree hydrocephalic; some are entirely so. Most of them are brachycephalic, quadrangular, with depression on top. In a peculiar class of cases, first studied by Virchow, that of the cretins and semi-cretins, rhachitis is combined with a premature ossification of the occipito-sphenoid synchondrosis. In this condition the base of the skull is shortened. At the same time there is a deep grooving of the root of the nose, the eyes are widely separated from each other, there is shortening of the vomer, and the flat palate, so characteristic for cretinoid conditions. Not infrequently the occiput is slightly flattened, and the oblique diameters are sometimes not equal, so that one side may appear to be entirely flattened. This is particularly the case when we deal with rickety softening of the cranial bones—craniotabes. In such cases there is much perspiration, with loss of hair on the occiput; the veins are more dilated, the skin thinner and paler than in the average case. In these cases of cranio-tabes one side may be flattened and the other side bulging. The head may even appear to be triangular. Where one side bulges out, and one side is flattened from pressure, the forehead is very prominent, the frontal bone may have three to five times its normal thickness, because of an immense amount of new periosteal soft growth between the periosteum and the bones, which produces a marked deformity of the forehead. This is not always a temporary affair. It is true that craniotabes may leave no trace

if it gets well sufficiently soon; but when there is much deposit under the periosteum, it will sometimes remain. When calcification takes place very suddenly, then the thickening of the bone will remain unabsorbed for life. As a rule, however, most of such thickenings are absorbed.

The condition of the teeth is certainly one which should be considered in connection with rhachitic deformity. The teeth appear late or irregularly; when early, the intervals between the first crop and the second, or between the second and the third are very long, sometimes six, eight, or ten months. The teeth are frequently discolored, and they decay very easily. Sometimes, however, we find in the second crop that the teeth are very hard and very yellow. Not infrequently we see "Hutchinson teeth" in rhachitic children. This is one of the reasons why Parrot got the idea of explaining every case of rhachitis as the result of syphilis. The lower jaws are short, narrow, and very low; the angles very sharp and prominent. The alveolar processes turn inward. Thus, the teeth of the upper jaw do not cover those of the lower jaw. The chin in some cases is very low. From the foregoing remarks it will be seen that well-marked rhachitic heads present a very peculiar appearance.

The trunk in rhachitic persons is very short. The clavicle shows much periosteal thickening; it is very frequently bent forward by the pulling of the muscles, and there is not infrequently an infraction between the middle and anterior thirds.

The chest is the seat of a great deal of deformity. It is frequently triangular, sometimes quadrangular; the dorsum is flat and the scapula clings to the body. The ribs, being soft, form a groove in which the arms are frequently buried. There is a predominance anteriorly. On account of the atmospheric pressure laterally above the diaphragm, there is a horizontal groove, called "Harrison's groove." As there is compression above the diaphragm the lower ribs stand outward. As the chest is compressed laterally the sternum is made to protrude, particularly about the third and fourth ribs, and the antero-posterior diameter lengthened. The ribs are prominent at the ossification points. On the cartilages there are frequently nodulations; a complete rosary may be developed quite early. I have seen it at the age of two months, and a

case has been published in which there was a complete rosary in a baby of only three weeks. In these extreme cases, the sternum is flat, and the manubrium stands out. Frequently it is pressed down above so as to stand out at an angle at its lower end. The lower end of the sternum may be retracted while the ensiform process protrudes.

Kyphosis is very frequently seen in these cases. It is often but an exaggeration of the normal curvature. Scoliosis has mostly its convexity to the right with compensation above and below. The spinous processes are very frequently directed to the concavity. The intercostal spaces are very narrow on the left side, because there is less curvature of the ribs, and the ribs are bent out.

In the grown-up woman the antero-posterior diameter of the pelvis is shortened. This is not seen to the same extent in the babe. In the normal baby the pelvis is small and the sacrum very steep, not concave as in the adult. Therefore, when compression has taken place because of softening, it is still smaller, so that it is often quite difficult to examine the pelvis satisfactorily; the sacrum may be so changed as to give rise to a convexity inward and contraction of the two sides. This narrowing may be due to the mere fact that the softened bones are compressed on the pillow, or by the arms of the nurse, a pressure which is slight, it is true, but quite sufficient. In very mild cases the symphysis is changed but little. In a number of instances, however, it will be found to be bent forward, and thus in very early rhachitis the rhachitic pelvis may be very similar to the pelvis deformed by osteomalacia. This is contrary to the usual description in the books on obstetrics.

The extremities suffer in different ways in all their parts, the epiphyses and diaphyses, the periosteum, and the epiphyseal cartilages. The epiphysis is frequently thick and painful, particularly on the forearm and tibia. A number of cases of so-called "growing pains" are simply instances of rhachitic epiphysitis. Sometimes the thickening is very considerable; in most cases it is uniform, but in some it is more developed laterally. This is particularly the case on the upper part of the thigh. The diaphysis is usually bent. Semi-fractures take place on the arm, clavicle, and legs, from a very trifling application of force. The periosteum, however, being soft, always acts as a shield to the inflamed bone when exposed to the

danger of fracturing. In all those cases in which there is much curvature, particularly in the lower extremity, the concavity is inward, and on the forearm and thighs it is very often anteriorly. The difference in the direction of the curvatures depends on the influence of the muscular traction or of the weight of the body. In the very young the concavity of the lower extremity is inward, because of the effect of the flexor muscles. When the bones become, or remain, soft in those who attempt to walk, the weight of the body results in outward curvatures and torsions of many kinds.

The ligaments are very flabby, and give rise to flat-foot in children that stand up and attempt walking. The periosteum suffers a great deal and in different ways. It is softened and exhibits a thick layer of rhachitic deposit. Calcification occurs in time, and then the diaphysis will be much thicker and harder than in normal conditions. The bones of rhachitical patients, when recovered, are solid and able to stand a great deal of hardship in later life.

In the rhachitical periosteum there may be hemorrhages. Not infrequently in bad cases of rhachitis, and in those cases which in the course of general ill-nutrition develop purpura, there are hemorrhages under the periosteum in the lower and upper extremities. Such cases of decided rhachitis, and those which exhibit similar hemorrhages without being markedly rhachitic, have been thrown together under the heading of, in this country, "scurvy," and abroad, "acute rickets." In all of the cases the children are ill-fed; there is a great deal of pain in the lower extremities and feet, sometimes with and sometimes without periostitis. The hemorrhages will heal and leave a thickening in part of the cases. Hemorrhage of the gums is not a requisite for the diagnosis; it may be absent in those who have no teeth, or who have, and present even where there are no teeth.

Finally, deformities consisting of shortening of the whole limb are due to the early calcification of the epiphyseal cartilages, for it is on their physiological function that the length of the diaphysis depends. When calcification is complete the growth of the bone and that of the limb ceases.

I wish to remind you that rhachitis is a general constitutional disease. In it we have to deal not only with the bones, but with the general system, particularly with another part of the locomotor

system—the muscles. The muscles suffer just as well as the bones in rhachitis, and give rise to certain deformities. Both voluntary and involuntary muscles are affected. What has been called rhachitical pseudo-paralysis is not paralysis; it is simply a weakness of the muscles, and nothing else. We should have been spared this new term. The muscles are simply poorly developed, and in consequence they are easily fatigued. The involuntary muscles suffer in the same way.

While the muscular tissue is poorly developed, fat is liable to be ample. Rhachitical children, unless emaciated by pulmonary or intestinal disease, are apt to be heavy and rotund, and their weight and appearance are often mistaken for healthy development. But they are flabby, anæmic, and not capable of resisting the attacks of ordinary disease like well children. They prove, moreover, that weight alone is not the measure for healthy and steady evolution.

The muscles in such subjects are flabby, and, consequently, the stomach is apt to be dilated, and the muscular layers of the intestines are apt to give way, thus giving rise to large, flabby abdomens filled with gas, on the surface of which are dilated veins.

The expansion of the intestines, owing to the weakness of the muscles, gives rise to constipation. This constipation is characteristic. Rhachitic children become constipated very early. It is sometimes the first symptom of rhachitis, and shows that the muscles participate in the process at a very early stage. It may begin at the second or third month of life in a child presenting evidences of fairly good nutrition ; and it at once leads us to suspect rhachitis. Some deformity of the abdomen may be due to the spleen, liver, and kidneys. In consequence of "Harrison's groove" the liver and spleen are not infrequently displaced, and these organs for the same reason may appear larger than they really are. The kidneys may be found floating. Most of the cases of floating kidney occurring in children that I have met with were in rhachitic patients, showing "Harrison's groove" well developed. But there are cases in which the spleen and liver are actually enlarged from slow congestion and interstitial hyperplasia. They cause the same deformity that is occasionally seen in syphilitic subjects. This is another reason why Parrot came to the conclusion that every case of rhachitis must be syphilitic.

RHACHITIS.

Its Various Manifestations, Diagnosis, Differential Diagnosis, and Prognosis.

By BENJAMIN LEE, M.D.,
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The essence of rickets being the failure on the part of the system to assimilate the earthy salts, and especially the phosphate of lime, we should naturally look for its principal manifestations in those tissues of which lime and phosphorus, singly or in combination, form essential constituents, namely, the nervous and the osseous tissues. And, the nervous tissue being more sensitive to irritation and more prone to rapid trophic changes than the osseous, it would not be unreasonable to expect that the results of such imperfect nutrition should first manifest themselves in the perturbation of functions peculiar to it, even though the organic processes of impairment might be going on simultaneously in both. For reasons which we do not understand, however, the nervous disturbances may sometimes be so slight as to elicit little attention, or, even if somewhat marked, may be entirely misinterpreted even in cases in which the degeneration of the osseous tissue becomes considerable. The comparative rarity of the affection in this country is apt to throw us off our guard, and many cases of this disease run their course under the name of gastro-enteritis, intestinal indigestion, intestinal catarrh, and so on, all of which conditions, indeed, may complicate the initial disease. In thus broadly characterizing the nature of this disorder, I do not forget the fact that it has been demonstrated that arterial enlargement or dilatation is a frequent, if not an invariable, accompaniment of the other changes; but it appears to me more philosophical to regard that as one of the

morbid processes due to the vice of nutrition rather than as the cause of the alterations in the tissues referred to.

It is a well-established fact that children may be born rhachitic. In that case the symptoms of faulty nutrition of the nerve-centres may be present from birth. Otherwise they may develop at any time in the course of the first three years of life, but oftenest during the period of lactation. It is not uncommon for a rhachitic infant to appear vigorous and robust during the first two or three months of life, and even to take on an excessive amount of fat. It will usually, however, offer indications of indigestion, especially in the intestinal tract. This may be accompanied either by obstinate constipation or by diarrhœa; at first oftener by constipation. Frequent attacks of severe colic are not uncommon. The abdomen is tumid. Such infants are poor sleepers, having restless, disturbed nights. It goes without saying, that we should be more on the alert for early indications of this trouble in bottle-fed infants than in those at the breast. This condition may continue for from one to three or four months without further development. It may be that unduly retarded dentition will be the first circumstance to call attention to the probable character of the disturbance. As nutrition of the brain becomes more impaired nervous irritability increases, as evinced by constant fretfulness indicative of suffering, restless tossing, especially of the arms, rolling the head from side to side, and loss of interest in surrounding objects. Convulsions are not uncommon. Some writers go so far as to say that rickets is by far the most common cause of infantile convulsions. This statement appears to me somewhat exaggerated. When they do occur they present the ordinary picture—fixation of the eyes, pallor, rigidity, embarrassed respiration, with inversion of the thumbs and great toes—"carpopedal contraction." The tonic spasm known as tetany is of frequent occurrence. Less severe cerebral irritation may be manifested simply by twitching of the eyes and lids or of the facial muscles. These disturbances may continue for a few days or may persist at intervals for months. One of the most characteristic of the convulsive manifestations is that of spasm of the larynx, to which the name of laryngismus stridulus has been given, from the hoarse metallic tone produced by the rushing of the air through the tense glottis when the spasm begins to relax. This may occur

in various degrees of severity, from a mere momentary holding of the breath to so prolonged a period of suffocation as to threaten, if not actually cause, death.

Implication of the vasomotor nerves is indicated about this time by enlargement of the arteries, already referred to, consecutive enlargement of the veins of the head and the neck, and profuse sweating of the head, especially during sleep.

To the same general cause may be assigned the bronchial catarrh, accompanied by cough, which passes under the name of chronic bronchitis, and often masks the true character of the disorder. Sensory disturbances of the nervous system may occur at almost any time. These manifest themselves as general hyperæsthesia, the flesh being sensitive to pressure at any point, or as tenderness in the joints, producing pain on motion. The child then shows the greatest disinclination to being moved, preferring to lie undisturbed upon the back, and caring little to be amused. Should he be old enough to walk he will gradually evince less and less desire for locomotion until he abandons the effort altogether. This has been explained by the fact that walking caused pain, or on the ground of general debility. My own belief is that there is an actual paresis in many cases, due simply to nerve starvation, and affecting more particularly the nerve fibrils distributed in the muscular tissue, in which the processes of metamorphosis and nutrition are to so great an extent carried on.

More or less closely following the manifestations referable to deficient nutrition of the nerve-tissue appear the trophic changes in the bones. One of the earliest is that known as cranio-tabes, consisting in defective and irregular development from the various centres of ossification in the skull, and perhaps even of absorption of bone-cells. This is noticed in undue patency of the fontanelles and sutures and irregular depressions in the occipital region. The sensation conveyed to the examining finger is that of the existence of small oval hollows or soft spots in the occiput. The head is not unusually large unless hydrocephalus be present, but is apt to be long, and the forehead is somewhat prominent and bulges laterally, like the prow of a Dutch lugger. Not only is dentition often delayed, but the teeth emerge more widely separated than usual, and are frequently notched as in inherited syphilis. It is in the long

bones, however, that the more striking changes occur. These are enlargement of the epiphyses and softening of the shafts, the former due to excessive proliferation, the latter to loss of the mineral framework. The wrists and ankles become awkwardly large and bulbous, while the shafts yield to undue pressure or muscular contraction, thus producing curvatures in the limbs. Among the first of the long bones to afford indication of the changes going on are the ribs, which become enlarged at the sternal extremity, or "beaded," as the phrase is. To this succession of small prominences along either edge the French have given the somewhat fanciful name of the "rhachitic rosary." Curvation of the shafts may begin very early, especially in the tibia. While it progresses more rapidly under the pressure of the weight of the body if the patient is walking, yet it is easily recognizable in infants who have never attempted to stand.

The deformities caused by the rhachitic vice of nutrition are so varied that to describe them would open up the whole subject of orthopedics. Bow-legs, knock-knee, flat-foot, the various spinal deviations, pelvic irregularities and contractions, and thoracic distortions may all be traced to it. The deformity of the chest is characteristic. The clavicles (well named) lose their power to act as braces, their curves become exaggerated, the shoulders fall together, the sternum and, with it, the anterior extremities of the ribs are forced out, and chicken-breast is developed, often exaggerated at the base of the thorax by the abdominal distention already referred to.

Lateral curvature of the spine, although often resulting, is less frequently observed than posterior curvature, involving the entire spine, but most marked in the dorso-lumbar region. In standing this curve is often apparently reversed, owing to obliquity of the pelvis and the necessities of equilibriation, producing a marked lordosis.

The diagnosis of rickets is a matter of little difficulty when once the characteristic bone-changes have developed in any considerable degree, and it is in that stage that cases usually come under the observation of the orthopedist. But in the early months of the affection, when it is usually amenable to treatment, as hinted at the opening of the paper, it unquestionably often escapes recognition

until irreparable injury has been done. Constantly compelled, as we are, to witness the life-long mortification and misery which attend the later manifestations, it would seem to be our duty to call the attention of family practitioners to the great importance of being on the watch for the earliest indications of the disease in artificially nourished infants. This affords one of the many fields opening for preventive medicine. The diagnostic marks have been sufficiently pointed out in the description of the manifestations of the affection.

As regards the *differential diagnosis*, attention has already been called to the fact that in its incipiency it is frequently treated for comparatively long periods as a gastro-enteric disorder, just as spinal caries has too often been, owing to the fact of its initial gastralgia. The practitioner may also be misled by the *quasi* chronic bronchitis.

Bradford and Lovett in an admirable *résumé* of the subject in their *Treatise on Orthopedic Surgery*, say: "Rickets is so often the outcome of a long period of ill-health that it is difficult to say where the rhachitic symptoms begin." To this statement I take respectful exception. I believe the long period of ill-health which often precedes the characteristic lesions to be simply the initial stage and not the cause of the disease. It is the failure to recognize this initial stage which leads to the development of so much deformity. Any bottle-fed infant who suffers from constant indigestion and nervous irritability should be subjected to the most careful scrutiny. If profuse sweating of the head, abnormally large secretion of urine, copious phosphatic deposits in the urine, and hyperæsthesia are found to exist, it is quite unnecessary to wait for lesions of the osseous tissue to confirm the suspicion of the existence of rickets.

Rhachitis may be mistaken for Pott's disease, true lateral curvature, congenital syphilis, and acute rheumatism.

The first-mentioned affection is the only one which is likely to produce much confusion in the mind of the practitioner, and from that the discrimination is often extremely difficult when the excurvation is in the lower third of the spine.

In Pott's disease the rigidity is greater and more persistent, especially on first awaking from sleep; the paroxysms of pain are more acute, and in the intervals of pain the little sufferer is comparatively cheerful. There is not the history of traumatism in

rickets which is almost always found in caries. There is often a peculiar transparent waxy pallor in the earlier stages of rickets which does not accompany the same stage of the tubercular disease.

Idiopathic lateral curvature rarely occurs at the early stage at which rickets appears, and the latter disease has set its unmistakable seal on other parts of the skeleton before the spine has begun to show serious indications of distortion.

Acute rheumatism is rare in infants, is acute in its course, and is usually accompanied by high fever. The periarticular swelling, with frequent red discoloration of that disease, is quite unlike the clubbing of the ends of the bones in that under discussion.

The absence of snuffles, sore-throat, and mucous-membrane and skin lesions serve to differentiate the latter from syphilis of the newborn, although there is some similarity in the bone changes.

Of the necessity for the exercise of the utmost care in avoiding the error of confounding the early symptoms with those of simple bronchitis and gastro-enteric disturbances, and of the means of so doing, enough has been said above.

The *prognosis* of rhachitis is to be considered with reference first to fatal result, and secondly to the production of deformity.

The books usually make very light of the gravity of the affection as threatening life. It certainly figures very rarely in the mortality returns. I believe that this is due in part to failure to recognize the disease, and that very many cases which have the death certificate made out for acute pulmonary diseases, convulsions, or disorders of the digestive tracts, ought properly to be labelled "rickets." An affection which so profoundly affects the nutrition cannot be regarded as trifling. The diarrhœa of rhachitis will sometimes carry off its victim in a few hours with all the violence of *cholera infantum,* and the bronchial catarrh which has continued for weeks with little modification may suddenly terminate in a fatal engorgement of the lungs. Too great vigilance cannot be exerted, therefore, for the detection of the disease at the earliest possible moment, inasmuch as the usual remedies for the other affections named, if not positively harmful, will at least have no beneficial effect on this deep-seated vice of assimilation.

Discovered in time, however, it is usually amenable to treatment, and in the very large majority of cases not only can life be saved,

but serious deformity can be averted. It is often as surprising as it is gratifying to see what appropriate regimen and medication, unaided, will accomplish toward the correction of very marked distortions of rhachitic origin. Add to these the potent influence of massage over the nutritive processes, the mechanical redressment which can be effected by carefully regulated exercise, both passive and active, and our ability to control and correct processes of deformation by judiciously devised appliances, and the outlook becomes a very hopeful one. When once decided changes have shown themselves in the skeleton, even if distortion can be avoided, loss of stature will inevitably result.

In conclusion, I would call attention to the fact which I think I have observed, that rickets and its congener, scurvy in infancy, have within the past few years been decidedly on the increase. In point of fact, if one looks over the text-books on the diseases of children, written forty or fifty years ago, he will fail to find the slightest allusion to the last-named disease. And this, notwithstanding the fact that our fathers in medicine saw it twenty times in the adult where we see it once. Manifestly it was not for want of familiarity with its symptoms that they failed to recognize it as one of the infantile diseases. Indeed, we need hardly go back more than ten years to find medical literature barren of allusions to this subject. To what are we to attribute this somewhat sudden increase in diseases of defective nutrition. Is it simply a coincidence that this condition has developed simultaneously with and *pari passu* with the introduction of the practice of the sterilization of milk? One curious feature of this increased development of these affections is that we meet it not among the poor, not among those whose hygienic environment is faulty and whose food supply is insufficient or of inferior quality, but among the children of the wealthy, who live under the most favorable conditions, with strictest attention to hygienic precautions and an abundant supply of the richest milk.

Let us consider for a moment the part which ferments play in the preparation of food for digestion and assimilation. We know to how great an extent the digestibility of the great staple of life, bread, is increased by the development in the flour of the *saccharomyces cerevisiæ;* how beer in its various forms becomes a whole-

some drink through the action of the same ferment; how the vinous fermentation furnishes both healthful beverages and useful stimuli; how the acetic fermentation supplies us a most valuable condiment. We also know that of all the ferments none approaches so near the fluid known as the gastric juice as lactic acid. We know what a wholesome and nutritious article of diet milk becomes in the shape of curds and whey, buttermilk, cheese, and matzoon, after having been acted on by the lactic-acid ferment. We know that under all ordinary conditions milk contains the lactic-acid bacterium. Now, is not the supposition warranted that, up to the point when this ferment has been developed in milk to such an extent as to produce an acid taste, which leads most persons to dislike it, its action on that fluid may be in the highest degree favorable to its digestibility and assimilability? Moreover, may not the lactic acid have a very important function in taking up the lime-salts, and in combination with phosphoric acid, putting them in condition to be absorbed by lacteals and appropriated by the system? The fact that sterilized milk is indigestible no one questions. May we not be denying our infants some of the most important of the constituents of milk, allowing them only the fats while we deprive them of the salts? To atone for presenting then a less-digestible milk we pre-digest it, thus depriving the stomach of the natural stimulus afforded by the presence of food requiring digestion, discouraging the secretion of the gastric juice, and still further interfering with the assimilation of the mineral constituents. Do we not perhaps need to revise our recent conclusions on the subject of infant diet and sterilization of milk?

RHACHITIC DEFORMITIES.

Mechanical and Constitutional Treatment.

By SAMUEL KETCH, M.D.,
NEW YORK.

Rhachitis in its more acute manifestations is comparatively rarely seen by the orthopedic surgeon. Not until deformity appears as a result of the constitutional taint, either in the form of curvatures of the spine, deviations in the long bones, as seen in bow-legs and knock-knees or in other distortions, is the patient brought to the specialist for mechanical or surgical relief.

In the discussion, therefore, of the constitutional treatment, I would first like to bring prominently before you the question of the prophylaxis or prevention of deformity.

While the literature of orthopedy is very complete with statistical, clinical, and therapeutical facts, too little attention has been given to the subject of prevention. Especially is this true in deformities the results of non-inflammatory conditions. The same remark which I used some years ago in reference to diseases of the joints, *i. e.*,[1] "The application of prophylactic laws to articular disease lies rather in the arrest and prevention of chronicity than in eradication; that in the present state of our art this will be the nearest approach to prophylaxis possible. Therefore, it is only by the earliest recognition of the symptoms and in the appreciation of their importance that this end—prevention—can be accomplished," applies with equal force to the deformities under discussion.

In none of the various conditions that the physician encounters is there so much opportunity for the prevention of subsequent deformity as in those the result of the rhachitic taint. Here the

[1] "The Present Status of the Treatment of Rotary Lateral Curvature of the Spine." N. Y. Med. Journal, May 19, 1888.

general practitioner has a province of unusual importance, and it is especially so in the earlier stages of the disease, where the constitutional symptoms are in excess, that his valuation of the general condition and the measures taken play such a large rôle in the prevention of deformity.

Remedies addressed to the condition of malnutrition should of course take pre-eminence. But the physician should always have in view the question of possible ultimate deformity; and its prevention by appropriate care and proper manipulation of the body is as much a matter of constitutional treatment as is the administration of phosphorus, cod-liver oil, syrup of iodide of iron, or other restorative agents. One of the most important means toward prevention of deformity is the avoidance of injurious positions in the earlier stages of rhachitis.

Many of the deformities of rhachitis are undoubtedly due to this cause, and while it is true that deformities may develop where infants are, by lack of muscular strength, unable to assume any but the recumbent posture, the chances are in the majority of instances minimized by a strict adherence to this position. Especially is this true in the "tender stage" of the malady. Here unfortunately the history of many cases shows that the child was encouraged to walk, either through the ignorance of the parents or lack of appreciation of the general condition causing the pain. The patient seeks naturally for the position of greatest ease, often at the expense of some portion of the body, and thus superincumbent weight is added as another element toward the development of deformity. As a general rule, therefore, the recumbent posture is indicated, but this recumbency must be varied by changes in this position, care being taken that the child be not allowed to remain either prone or supine for too long a time, and frequent changes made from one to the other. In this connection the advantages and benefits of fresh air should not be forgotten, and toward this end the portative frames, of which many have been devised, are useful both for transportation and for the carrying out of the postural treatment.

Much also may be done during recumbency by proper manipulation of the parts involved. While more will be said about manual force in speaking of mechanical treatment, the use of manual exercise at this early stage must not be neglected. Gentle

pressure by the hands to those parts in which indications of deformity are already present should be strongly urged, this pressure being made in an exceedingly cautious manner, but regularly and under the care of one person who has been properly instructed.

The general constitutional measures for the treatment of rickets must necessarily fall to the lot of the general practitioner; but even when coming to the specialist at a later date, with deformity already declared, should still be enforced. So long as the healing process is not well established—in other words, as long as the bones remain soft—so long must constitutional remedies be used, and are important adjuncts to local and mechanical treatment. Proper feeding, bathing and general hygiene, are of prime importance, and in certain cases of even greater value than medicinal agents; change of air is imperatively indicated at times, and in conjunction with proper support of the parts involved has effected a cure. In the choice of medicinal means, no routine measures should be advised. Each case should be studied from its own standpoint and only such remedies be employed as indicated by the condition of the patient.

Thus the choice of phosphorus and its combinations, cod-liver oil, the different preparations of iron, or other roborants must be a matter of judgment on the part of the surgeon, and be varied from time to time as changes in the condition of the patient occur.

The mechanical treatment of rhachitic deformities will be considered under two heads:

1. Manual or local.
2. By use of apparatus.

It may be stated as a general proposition that the use of apparatus in very young children should not be enforced. The tissues of this class of patients, as a rule, will not admit of long-continued pressure, and it is especially in this class that the indications exist for the use of manual force.

Of the rhachitic deformities coming to the orthopedic surgeon the most frequent are curvatures of the spine and long bones. Other deformities, such as alterations in the cranial bones, thorax and pelvis, while frequent, are either too far advanced or beyond help by mechanical means. Even these, if seen early enough, I believe amenable in whole or part by manual force.

It seems strange, in view of the success obtained by manual

means in other deformities in young children, so little attention should have been given to this method of treatment in rhachitic deformities. In another paper[1] read before this Association I have endeavored to give some pathological conditions on which were based the indications for the use of manual force.

Attention was called to the fact that in many of the cases the stage of softening in rhachitis was of long duration, and that in some instances, even after the lapse of months or years, the bones were still found pliable and yielding. Briefly speaking, the pathological conditions found in rhachitic bones may be best described under three stages:

1. Stage of congestion.
2. Stage of softening.
3. Stage of sclerosis.

It is a well-known fact that most of the deformities due to rhachitis occur in the earlier periods of bone development coincident with the stages of congestion and softening; this is especially true of curvatures occurring in the long bones.

Here it has been shown by Rindfleisch, Hetzman, and others that instead of the normal ossification, where the cartilage is reduced to an embryotic condition, giving rise to medullary cells and the formation of blood vessels, we have a hyperplasis with an excess or over-rapidity of this preparatory process, and only a scanty production of new bone from the medullary tissue. During this hyperactive process the bones can be bent by the least possible force. It is also at this time that we find the marked ligamentous relaxation that is observed in all of these cases, and in bow-legs and knock-knee abnormal lateral mobility is a constant symptom during this period. It is at this time that manual treatment is of the greatest service, and is often all that is necessary in conjunction with the general constitutional remedies. The direction and amount of force used manually are matters of judgment, and will depend largely on the condition of the parts. The ease with which the bones can be sprung toward the normal position should be the measure of the force applied. It should be used at least twice daily, and the patient seen often enough by the surgeon to compare

[1] "The Manual Treatment of Bow-legs and Knock-knee." Read at the annual meeting of the American Orthopedic Association, St. Louis, 1893.

his tracings and enable him to compute progress. It is not necessary to have the force painful, but the pressure should be firm, the parts being held in their improved position by the hands for some minutes. It is my own rule to use manual force throughout the whole time of treatment, even where it has been found necessary to use apparatus.

Treatment by Apparatus.—In older children who have already walked some time the use of apparatus is frequently called for. Especially is this true in the most frequent rhachitic deformities, bow-legs and knock-knee. It would be nearly impossible within the limits of this paper to give a description of all varieties of apparatus that have been used in the treatment of rhachitic deformities. It will possibly be more profitable to speak of the principles involved in the treatment by apparatus. As ordinarily constructed apparatus for the relief of rhachitic deformities embody the following principles :

1. Fixation or retention.
2. Continuous pressure.
3. Intermittent and elastic force.

Examples of the first class are represented by the ordinary walking apparatus applied in cases of knock-knee or bow-legs, and by the braces used in rhachitic lateral curvature of the spine. Here the mechanical effect desired is simply to hold the deformed parts in the best possible position, and preventing an increase of deformity by superincumbent weight or muscular force. Here we have an example of an apparatus which is non-progressive in character. Apparatus of this class should be light, of such material that they can be frequently modified, and easily removable to allow of inspection of the parts, and simple enough in their action to be properly applied and adjusted by those having the home care of the patient. In the use of fixation braces it is of especial importance that conjoined manual treatment should be used, and any improvement be followed up by accurate modification and adaptation of the apparatus to the new position.

The continued application of pressure to rhachitic deformities is represented by those means where the parts are encircled by plastic material and strong force is exerted against the deformed parts. It has been observed in certain forms of rhachitic deformity that

by placing the parts in certain positions the deformity disappears. This is well exemplified by flexion of the knees on knock-knee. Hueter in these cases retained them by a plaster-of-Paris bandage. The same idea has been used in rhachitic curvature of the spine with or without suspension. There are grave objections to this mode of treatment. In addition to the complete crippling of the patient, as in cases of knock-knee, we are unable to accurately watch the condition of the parts under the plastic envelope, and excoriation with extensive ulceration and sloughing has taken place. This method has practically been abandoned by surgeons at the present day.

The third class would represent apparatus of the active or progressive type. Their object is to exert an active force, either by intermittent action or by elastic traction. The use of intermittent force in this clsss of deformities as well as others has been largely developed by Dr. N. M. Shaffer. He has called attention to the value of momentarily exaggerated pressure in many distortions, and uses it in rhachitic bow-legs by means of an apparatus described in an article on "Knock-knee and Bow-legs."[1] Of apparatus constructed on the principle of elastic traction there are numerous varieties. Roberts', Mickulicz's and Vogt's modification are prominent examples. Here it is attempted to supply a constant force acting against the deformity and in a direction opposed to it. In Germany many successful cases are reported as having been cured by this method.

In closing this rather summary discussion I wish to call your attention to the question of the time involved in the mechanical treatment of these deformities. It has been urged by many that much time and expense would be saved by early operative measures. While there may be emergencies which would prevent mechanical treatment, it must be allowed that after operation, as long as the bones remain soft, some retentive walking apparatus must be used, and thus the gradual mechanical reduction would not actually cover a longer period. It should be a cardinal rule that as long as we are dealing with rhachitic bones still in the stage of softening, that mechanical treatment should be patiently and thor-

[1] A lecture on "Bow-legs and Knock-knee." Am. Journal of Obstetrics and Diseases of Women, July, 1893.

oughly pursued. Only when eburnation has taken place, as evidenced by loss of resiliency, or actual drilling as proposed by Sydney Roberts, are we justified in resorting to operative measures.

A word as to the "growing-out" theory will, I hope, not be amiss. It is unfortunately a too common practice to dismiss many of these cases with the idea that time and nature will correct the deformity. While I do not deny that cases untreated by apparatus do recover, I have as yet failed to appreciate the signs whereby this prognosis can be made. Until such time of accurate prognosis arrives I shall emphatically protest against this idea, and give the patient the benefit of the doubt.

In conclusion, a word regarding the abuse of apparatus. The mechanical treatment of the deformities under discussion, as well as other deformities, by the use of braces, has been much retarded by a popular prejudice in the minds of the laity regarding their use. This to a certain extent can be accounted for in the fact that many of these cases find their way to the uneducated instrument-maker. This indiscriminate use of apparatus is to be deprecated in the strongest possible way, and it should in my opinion be the duty of this Association and each individual member of it to oppose this unscientific and even dangerous procedure to the utmost, if necessary, even by legislative action requiring the care and supervision of a competent and educated medical man in this class of cases. The place of the instrument-maker is simply to construct an apparatus It is the duty of the surgeon to attend to its proper application.

RHACHITIC DEFORMITIES.

Operative Treatment.

By DE FOREST WILLARD, M.D.,
PHILADELPHIA.

The rhachitic deformities which chiefly concern the surgeon are those which occur in the lower extremities, although curves of the bones of the arm and forearm are occasionally capable of relief by the same surgical procedures that are employed in the bones of the lower limbs. Curves of the clavicle are usually irremediable. The humerus rarely requires correction, but the radius and ulna sometimes demand osteotomy.

The most important functions of the orthopedic surgeon are the prevention of bone distortions in rhachitic children by strict attention to food, air, and hygienic surroundings, and the forbidding of weight-bearing upon the limbs while the bones are in a softened condition, thus preventing the most serious deformity so far as regards human life, that is, alteration in the shape of the female pelvis.

One word in relation to the suggestion of Macewen in regard to osteotomy of the pelvis in parturient women in whom delivery is impossible from narrowing of the pelvic diameters. The operation is perfectly justifiable and would undoubtedly be effective. The recent revival of symphysiotomy, however, which at present seems both desirable and safe, renders this method of attacking the pelvis apparently unnecessary. Should symphysiotomy, however, from any cause fail to maintain its present position, and especially should severing of the pubic articulation result in feeble union, osteotomy

of the ramus of the pubis and of the ischium will become an established operation, since it would permit large dilatation of the pelvic outlet, and with perfect rest reunion would undoubtedly be secured.

The only procedures which we need consider in the correction of deformities are

1. Mechanical appliances.
2. Manual immediate rectification.
3. Osteotomy.
4. Osteoclasis.

1. *Mechanical appliances.* Mechanical measures are exceedingly effective in certain forms of rhachitic deformities, especially in lateral bowing of the leg before sclerosis of the bone has occurred; also for in-knee and out-knee before great rigidity has occurred.

2. *Manual immediate rectification.* Forcible manual straightening can be employed in moderate grades of deformity, and injury to the hard and soft parts can be regulated with accuracy. A half cylinder of wood, which can be padded as desired, makes a better fulcrum than a sand-bag. Force must be applied suddenly, while due care of the epiphysis is maintained lest separation occur. Of course the rectification is possible only in young children, as the bones of an adult are too strong for this form of treatment. Force must be intelligently applied, but it is so momentary in character that sloughing never results; at least I have never seen it take place.

The table should be low, so that the power of the surgeon can be fully exercised, and he should be on his guard in order to check the force as soon as the bones give way, or if a green-stick fracture results. The table must be absolutely firm, so that the surgeon can appreciate exactly the amount of force employed.

In the long out-bowing extending from the hip to the ankle, in young children, forcible straightening of the femur and of the leg bones may be employed; but for out-knee I do not approve of sufficient force to separate the epiphysis, as decided interference with growth results from traumatism at this point.

The dressings should be of plaster-of-Paris applied during over-correction to maintain the position accurately. In applying this dressing it is better first to fix the injured region and to leave the

foot and thigh until the end of the dressing, as better position is thereby secured.

3. *Osteotomy.* Osteotomy is, "par excellence," the operation for rhachitic deformities. Clean, sharp, effective, the osteotome is a most valuable instrument. When judiciously used it offers a sure and speedy means of straightening distorted bones, and it has only to be tried to be thoroughly appreciated. The instrument must be really a bone knife and of the form insisted upon by Macewen, a perfect isoclinal triangle; keen, with no shoulder near the point, the edge simply sharpened, and it must be thoroughly tempered.

Simple osteotomy is so practically subcutaneous that results should be as good as in simple fracture. When thorough asepsis of the limb, instruments, surgeon's hands, and dressings are secured, suppuration is almost unknown. I have performed the operation scores of times in the last few years, and can say with strict accuracy that I have not seen a drop of pus as a result. Formerly, when I more frequently practised cuneiform osteotomy, suppuration quite frequently ensued. Now I seldom drain, and rarely remove a wedge-shaped piece of bone, except in the very worst form of anterior curvature. Even when there is marked deformity, and when the straightening leaves a gap in the bone posteriorly, yet the interval is quickly filled with callus, and a perfectly strong and straight limb results. I have come to look for almost uniformly good results, and to expect to have the temperature-sheet exhibit an almost routine line. Occasionally accidents will occur. I do not use an Esmarch bandage, as the free outflow of blood is an excellent preventive against the ingress of air. In one of my cases hemorrhage was excessive, and I feared the corner of the osteotome had wounded the popliteal vein. I therefore enlarged the wound to search for the source. Failing to find any large vessel I tied two small ones, then closed the wound and secured primary union. This is the only time when I have felt at all alarmed by hemorrhage, and its source was evidently from the bone.

Frequently the oozing stains the cast over a considerable area, but plaster-of-Paris is so decidedly an antiseptic that decomposition of this contained blood seems to be prevented, and the cast remains sweet for weeks; I rarely remove the primary dressing until cure is complete, unless it becomes soiled by urine. I have adopted

gypsum dressing from the fact that it is the best, and the objections to it are trivial.[1]

For the varieties of out-knee and in-knee the plan of Macewen, to cut above the epiphysis of the femur, is certainly advisable. Osteotomy of the head of the tibia and fibula is sometimes necessary, but it is apt to produce free bleeding, and is quite a serious operation. The anterior tibial perforates the interosseous space just at this region.

Section of the femur at its middle is seldom necessary save for the sake of appearances.

4. *Osteoclasis.* Personally I do not like the osteoclast, although it is largely employed in France and by a few operators in this country. Cases which my hands fail to straighten over a wooden block I prefer to complete with an osteotome. There is less bruising of the tissue, less injury to the soft parts, the healing is quicker, there is but little febrile reaction, and extensive injury to the deep tissues is avoided.

From the moment of closing an osteotomy wound the injury becomes but a simple fracture; the air is excluded, and there is no interference with union. The injury done by an osteoclast has been proven by actual dissection to be very great. Necessarily the bone cannot break until all the outer layers of soft tissue have been either pressed apart or condensed, so that the force is expended directly upon the osseous structures. Many times also the skin is torn. The superior healing powers of cleanly cut tissue over such pulpified ones would seem to need no demonstration. The mortality from either operation should only arise from accident. The lack of precision of the exact point of fracture is also a most important objection. For all these reasons I employ osteotomy in preference to osteoclasis, although I do not deny that the advocates of this method show good results.

Conclusions.—1. Simple out-bowing of the legs before the bones are solidified is easily corrected by pressure from a properly applied apparatus. Long out-bowing, accompanied by out-knee, can also be overcome by mechanical means.

2. Forcible manual straightening over a solid fulcrum is often

[1] I have published my views upon the operation in the International Clinics for 1892, vol. iii.

desirable, even if simple or green-stick fracture is produced, in cases where the parents cannot, or will not, attend to the adjustment of apparatus.

3. Osteotomy is required in extreme cases of out-bowing in large children and adults.

4. In anterior curvature it is rarely advisable to employ apparatus. Manual fracture over a hard fulcrum, or osteoclasis, or preferable, osteotomy is advisable. Cuneiform osteotomy is seldom necessary, except in extreme cases, as even a wide intervening gap can be filled up by callus, and the simple operation is less liable to be followed by suppuration.

5. For out-knee or in-knee osteoclasis is not desirable, but osteotomy above the condyle of the femur is safe, effective, and speedy. A subcutaneous operation below the tibial tubercle is rarely required.

6. Curvature of the femur, unless greatly interfering with locomotion, does not require operation.

DISCUSSION.

Dr. Weigel said that a few years ago Dr. Willard had read a paper on osteotomy for the correction of anterior tibial curves, in which he had advocated the use of drainage. In his own more recent operations he had discarded drainage, making practically a simple fracture of a cuneiform osteotomy. Occasionally there was a mishap. Thus, linear osteotomy was done in one case of club-foot in which there was extreme rotation inward; the bone was twisted around more nearly to the normal position, and the usual dressing was applied. Through the negligence of the house-surgeon at the hospital, strangulation was allowed to take place, and as a result there was a rather extensive slough. He was subsequently obliged to cut down and remove the dead bone. With ordinary care and supervision after operation he considered either linear or cuneiform osteotomy perfectly safe and preferable to osteoclasis, because the point of correction could be much more accurately located. He would like to ask whether Dr. Willard still resorted to drainage.

Dr. Ryan thought that most of those who had done osteoclasis and had observed the effect of it in a number of cases would agree that the difference between osteoclasis and osteotomy was a difference between precision and uncertainty. There must be an uncertainty about the point of fracture in osteoclasis, and particularly when done in or about a joint. The condition of the soft tissues which necessarily follows osteoclasis was something which we should at least avoid. He thought cuneiform osteotomy had been practically abandoned except for the anterior curvature of the tibia. It seemed to him that the bleeding was in many cases very considerable, consequently if the wound were sealed, unless it healed by blood clot, there would be need for drainage. The question of the age of the patient was very important when osteotomy was under consideration. He had found that much poorer results followed the use of osteotomy in very young children. Photographs of persons shown often did not do justice to the cases, for it was perfectly impossible to place them so as not to make the deformity appear fully corrected, when in reality it had not been. He did not think osteotomy should be performed before the third or fourth year, as before this time there was liability to a recurrence of the deformity.

Dr. Arthur J. Gillette said that he had never performed osteoclasis, for he had always felt that it was a method of treatment lacking precision. He had never had any accident in doing osteotomy except in one case. In this case, he found at the end of six weeks what he took to be union, but he reapplied the cast for three or four weeks more, after which he pronounced union quite firm. He then lost sight of the patient for six or eight weeks, and on her return there was a worse deformity than before the operation. The deformity was reduced by manipulation and without an anæsthetic, and the parts were kept in plaster-of-Paris for two months, and then, although there was apparently good union, a brace was applied. The patient then went to Canada. When he saw the child a few months later, the deformity was again as bad as before. He could not explain the failure in this case.

Dr. Ansel G. Cook said he had operated upon five or six cases by osteotomy at the Hartford Hospital in the past two years. He

had also made it a practice to seal the wound, and had never seen a drop of pus, although in a number of instances he had allowed the house surgeon to do the operation. Of course, the results were not always as perfect as they should be, but he had always attributed such results to his own neglect to fully straighten the limb.

Dr. Bernard Bartow said, regarding the fear of injury to the soft parts by osteoclasis, he thought it was in most cases unfounded. He recalled only one instance where he had encountered difficulty of this kind—a case of severe curvature of the femur where osteoclasis was unequal to the task, and osteotomy became necessary. The injury here was comparatively trifling, although an enormous amount of force was used. He had taken the precaution to split a plaster-of-Paris splint anteriorly in four lengths, leaving the guard intact, so that if there was any swelling the muscle bandage could be removed and the plaster bandage spread.

Another feature in favor of osteoclasis, except immediately around the joint, was that in some cases we could bend the bone straight without resorting to actual division. This was certainly a great advantage, both as regards the ease of maintaining the position and the rapidity of recovery. A "green-stick" fracture seemed to him superior to the cure effected by osteotomy, because the bone itself offered a partial fixation. For these reasons he favored osteoclasis in cases where it seemed at all applicable, provided the fracture was not made in the immediate neighborhood of a joint.

Dr. W. R. Townsend, of New York, said that among the advantages claimed for osteoclasis were that an open wound was not made, and that the bone was broken subcutaneously, and hence no infection. Two years ago when Mr. Grattan, of Cork, Ireland, had demonstrated the action of his osteoclast in one of these cases there was a laceration of the soft parts produced. The instrument had been previously oiled, and no special effort made to have the skin of the parts in an antiseptic condition. The case, however, did well. In another case, where he had himself performed osteoclasis with Sayre's modification of the Grattan osteoclast, there was sufficient abrasion of the skin to permit the entrance of septic germs. He had not been able to break the bone as exactly as he could have done with a chisel.

Dr. F. S. Coolidge said the amount of injury to the soft parts depended largely upon the kind of instrument used—in fact, all the points raised, good and bad, were entirely dependent upon the instrument. Lorenz had found that by protecting the jaws of his instrument with very thick pads of rubber, the skin had been prevented from being injured. He had tried it several hundred times altogether, both on the cadaver and on the living subject.

Dr. Bartow said he had never observed injury to the skin with osteoclasis, because he had invariably used a piece of moleskin plaster at the point where the pad and the girdles of the Rizzoli osteoclast would make pressure.

Dr. Ketch said that he thought the remark made by Dr. Ryan was misleading—*i. e.*, that some of his cases acted well without treatment. He did not think that any of these patients recovered without treatment. It might be that the treatment was not systematic or thorough. He had taken the trouble to make inquiries for the past two years regarding this point, and had found that all these children received massage or some sort of manipulation, the mothers invariably doing something of this kind. He had for many years protested against the "growing-out" theory. He would like to know very much from any one present whether there was any method of telling what cases would and what would not grow out of the rhachitic deformities. Until such a method was known, he did not think any cases of this kind should go untreated.

Dr. Ryan said he had simply stated what he thought every member believed to be a clinical fact—viz., that some of these cases did grow out of the deformity. He had in mind a whole family of rhachitic children upon whom he had been desirous at one time of beginning treatment. The mother could not give these four boys any attention whatever, and they were allowed to run wild; yet they had outgrown these deformities under his very eyes, for they lived near his office. These boys had received no massage or manipulation of any kind. Of course, he did not mean to say that this was a common occurrence. He did not believe anybody could define what cases would outgrow the deformity. The very fact that

Dr. Ketch made this inquiry was practically an admission on his part that some patients did outgrow the deformity.

Dr. Lee said that the alternative presented in the paper—the open wound of osteotomy or the laceration and displacement of the tissues subcutaneously as the result of pressure—was putting it rather too strongly. Might we not have under uniform pressure, not displacement or contusion, but simply a condensation of the tissues to such an extent as to permit the force to reach the bone, and yet the parts maintain essentially their normal relation and undergo no serious injury?

Dr. Willard said, regarding the question of cuneiform osteotomy which had been asked by Dr. Weigel, that he now rarely did cuneiform osteotomy, even in quite severe cases of anterior curvature, for he believed just as good results could be obtained in most cases by linear osteotomy. In the straightening out of a badly deformed anterior curvature after the linear operation a wedge-shaped gap was left posteriorly, but the avoidance of drainage and suppuration were so decidedly in favor of the linear osteotomy that he avoided cuneiform osteotomy almost altogether. When he did a cuneiform osteotomy he left the wound open, allowing the blood to ooze out, but he did not drain these wounds as a rule. He believed that he had not done that for at least two years past. He had not much confidence in healing by blood-clot. He saw many cases of ununited fracture following traumatism simply because there had been a large effusion of blood at the time, and Nature did not seem to be able to throw out sufficient callus in the presence of such a a large effusion of blood. In Dr. Gillette's case it was quite probable that there had been such an effusion, or else that a small spicule of bone had interfered with union. Such imperfect union might also be due to injury of a nerve. Quite recently he had helped out a professional brother in court, where he had been prosecuted because of the occurrence of gangrene which was thought to be due to improper bandaging. Examination of the amputated limb showed that at the time of the occurrence of the fracture a spicule of bone had injured a nerve, and the gangrene had originated as a result. He did not believe that the advocates of osteoclasis had succeeded

in proving that there was no extensive laceration of the soft tissues—not alone of the skin but of the subcutaneous tissues. He had never seen a lacerated wound heal as well as an incised wound, and he did not think we had anything like a compound fracture in osteotomy, for the wound at the completion of the operation was thoroughly sealed, and the healing was like that of a simple fracture. In his opinion, our bad results were often due to faulty dressings, applied in all probability by the assistant. It was the duty of the surgeon to attend to the dressings. He believed also that many rhachitic deformities in the lower limbs could be straightened by the hand method of bending the bone or producing a "green-stick" fracture. The most common mistake after osteotomy was in allowing the patient to go about without apparatus; it was much better to apply a supporting apparatus for one year.

THE CORRECTION OF THE DEFORMITY OF HIP-DISEASE:

Its Value During the Progress of the Disease; Its Importance on the Subsidence of all Disease—One Hundred Cases Analyzed.[1]

By V. P. GIBNEY, M.D.,
NEW YORK.

The enormous amount of material furnished by a large orthopedic hospital brings one face to face with a very difficult problem in the management of the deformities that arise during the progress and at the end of tubercular ostitis of the hip. I take it that the object of every method of treatment is to protect the joint against trauma. Whether it is better to correct deformity that arises in the course of treatment, or that has arisen before treatment is begun, is a question concerning which there is an honest difference of opinion. Nature herself prefers to throw the limb into an abnormal position in order, as it seems, to protect the joint; yet she is powerless to prevent the reflex muscular spasm which is a persistent factor.

It had occurred to me that, in view of the difficulty that we encounter in correcting deformity in the course of the disease, the older surgeons have not erred so outrageously in giving little heed to these deformities. During a long period of intimate personal observation I have found myself reverting to this period, and wondering whether, after all, it were not best to give less attention to the deformity while the disease is active, and simply supplement Nature in her efforts to protect. I have entertained these thoughts

[1] The figures illustrating the cases were kindly furnished by the International Medical Magazine.

because it is so easy to correct deformity long after the close of the disease.

The modern traction hip-splint, with which we have all become so familiar, is such a boon to humanity that we should be slow to criticise this apparatus, unless we can demonstrate a method of treatment that will afford equal comfort, and, at the same time, bring about a restoration of function and a limb free from deformity. To make myself clearer: all who have had a practical experience with the long traction splint know that it does prevent, as a rule, exacerbations; that it does give the patient a comparatively comfortable life during the three to five years necessary for its use. For at least a dozen years I became familiar with the natural progress of the disease unchecked by any form of apparatus. I recall vividly the agonizing pain of hip-disease, the frequent exacerbations, the hectic fever after the spontaneous opening of an abscess, the confinement to the house, the bed, or the wheeled chair, and the painful position into which the limb was thrown in the different stages of the disease. I can contrast with this another period of nearly a dozen years with this affection treated by apparatus, and I recall with much pleasure the ability with which these sufferers can get about, the freedom from the night cries and terrors of the disease, and the good condition of health brought about by freedom from reflex pains and burrowing abscesses.

It must be borne in mind that the peroneal crutch supplemented by traction is a means of continuous traction night and day. While I am willing to admit that deformity is the rule, I know full well that this can be corrected in a large proportion of cases, and that the correct position can be maintained. This paper is presented, not in defence of the present traction splint, but simply to show what can or cannot be done by persistent efforts at preventing deformity, as well as correcting it, in all stages of the disease.

Notwithstanding these reflections, I am convinced that it is better to correct the deformity, and at the same time employ appliances which will prevent its recurrence. The mode of correcting is not always clear. We have, for instance, several methods: the employment of weight and pulley on an inclined plane, which seems to be the most popular; the employment of manual force under an anæsthetic; the division of tendons, muscles, and fascia, supplemented

by manual force, with retention in a fixed apparatus; the excision of the joint, and osteotomy. The cases I have collected for analysis include nearly all of these forms of correction.

It is claimed by many, and with a certain degree of plausibility, that a patient can get more pleasure out of life if the case is cured with a moderate grade of deformity; for instance, fixation at an angle of about 150° in flexion. One can sit down the more readily with such deformity, but can walk with more ease and facility if the case be cured without limb deformity.

The early recognition of the disease has not been sufficiently impressed upon the mind of the general practitioner, and hence we who practise orthopedic surgery must encounter a large proportion of instances wherein deformity has already occurred and where it is impossible to conduct the case to a perfect cure. I use the term "perfect cure" to mean a restoration of the joint with the normal functions preserved, freedom from any deformity, and minimum amount of shortening. We have, therefore, a large percentage of advanced cases, and I am free to confess that we are not yet sufficiently skilled in the management of these cases to assure the patient that a perfect recovery will ensue from any plan or method with which we are familiar. All the members of this Association, I am sure, claim that, given the disease in its early stage prior to any shortening or deformity, a perfect result can, as a rule, be secured. It should be our aim, then, as orthopedic surgeons, to impress this claim upon the professional public, and lose no opportunity to demand a recognition of our abilities in this direction.

Before taking up the analytical part of the paper I wish to present a few cases that have seemed to me worthy of record. I make no claim that these are not selected cases; but a proper selection, with a study of the deformity itself, will enable us, I think, to get better results and make a better choice of cases for operation.

Case I.[1]—Maria D., twenty years of age, was referred to me on the 27th of January, 1891, for the correction of deformity. I found that she had been treated many years before at the Hospital for the Ruptured and Crippled. She had had the usual expectant

[1] These numbers do not correspond with numbers in the appended table.—G.

treatment, abscesses had formed, sinuses had resulted, and these sinuses had closed. After she left the hospital some one had applied a long Taylor splint with free joint at hip and cumbersome in the extreme. This girl being compelled to earn her living, and having a great amount of walking to do, she was thus caused a great deal of pain, with impaired nutrition, and her condition was a source of great annoyance. The atrophy of the entire limb was extreme. There were three inches practical shortening, two and a half inches real shortening. The limb was fixed at an angle of about 135° with the pelvis.

I advised a discontinuance of the apparatus, but she found that this only added to her discomfort, and on March 21, 1891, at the New York Polyclinic, I made an osteotomy below the trochanter minor, subcutaneously, brought the limb down parallel with its fellow, and encased limb and body in plaster-of-Paris. Beyond the nausea from the ether, she suffered very little in consequence of the operation, and on April 22d the plaster was removed. Union at the site of fracture was good; the limb was in excellent position. At this time there were one and a quarter inches practical shortening, with the real shortening unaffected. The use of axillary crutches and long traction splint for a few weeks was sufficient to complete the cure. By July 21, 1891, she had abandoned the splint, but was using one crutch. By November, 1891, there was only one inch practical shortening, the angle of deformity was about 170°, the limb was well abducted, she wore only a cork-wedge in the heel of her shoe, and walked without fatigue. I have seen this patient from time to time up to the present. She does not wear any cork-wedge in the heel of her shoe, she walks long distances without fatigue, earns her living with much more facility, her general health continues good, the limb is developing a great deal in size and strength, and it is difficult for one to appreciate her condition as compared with what it was in January, 1891.

Case II.—Laura T., eleven years of age, came under treatment April 18, 1890. She had been under treatment for five or six years also in the out-patient department of the hospital, under the care of my predecessor. She had not worn any apparatus during that period.

The deformity was about 150°. I was not convinced that the disease had subsided, and employed a long rack-and-pinion splint, which served an admirable purpose. I failed, however, to correct the deformity; her gait was very awkward without the apparatus, and on March 11, 1891, I did a subcutaneous femoral osteotomy, with the result that her shortening was reduced from about three inches to half an inch. The apparatus was continued for nearly a year after the operation, and it was not until May, 1892, that I allowed her to walk without any support. Her angle of greatest extension was about 170°; there was little or no motion at the hip, though there was no adduction. There was at this time less than an inch shortening. I saw her about a year later, and she walked very well indeed, presented scarcely any deformity, and the family were delighted with the result.

FIG. 1.

Case III. Showing angle of deformity with spinal column perfectly straight.

CASE III.—Edward M., thirteen years of age, has had quite a varied experience. The disease developed in early life, say about three or four years of age. He came under my care at the hospital. I was unwilling to take him under treatment, because at that time I had wearied of the expectant plan, and took the liberty of referring him to the late Dr. Stillman, who at that time was quite enthusiastic about his "sector" splint. He took quite an interest

FIG. 2.

Case III. Showing best position before operation.

in the case at first. The patient and the sector splint figured in some illustrated catalogues for a long while. The deformity increased in spite of the splint, the mother became discouraged, and on returning to me I put the case under the care of Dr. Judson, who employed the long splint. He finally succeeded in arresting the disease, presenting his case as cured in a series reported in vol. ii.

of the *Transactions* of the Academy. The deformity, however, persisted, and in October, 1890, the case came under my observation, this time with the consent of Dr. Judson himself.

I advised an osteotomy, but it was not until August 21, 1891, that I succeeded in bringing him to the operating-table. The angle of greatest extension then was 112°, greatest flexion 90°. The practical difference in the length of the limbs was five inches. The hip was marked with cicatrices. Tip of the trochanter was two and a half inches above Nélaton's line. The lordosis was very marked.

Fig. 3.

Case III. Showing final result.

Under ether I made numerous subcutaneous divisions of the tendons and fascia below the groin and on the outer side of the thigh, upper portion. Under force, after these procedures, it was

possible to reduce the deformity only about 20°. An osteotomy was, therefore, done, and I fancied that the deformity was fully corrected. The mother had grown so accustomed to change that she did not rest until the boy had been removed from the hospital, which was October 15, 1891, less than two months after the operation. The union, however, seemed good, and there was no infiltration about the site of operation. The practical difference in the limbs at this time was two inches. The angle of greatest extension was 165°. By February 6th he had lost 10°, and the practical shortening was two and a half inches. I employed a short Thomas splint to supplement the traction splint which had been used since the removal of the plaster. By April 9, 1892, he had a deformity of 165°, though the apparent deformity was much less.

I did not keep him under close observation, and by September 10, 1892, his angle of greatest extension was 140°, practical difference in the limbs two and a half inches. The tendo Achillis was likewise shortened, and this added to his deformity. Another osteotomy was advised, and a few days later the operation was performed, with the result a year later of 160°, a two-and-three-quarter-inch-high shoe, and a very good limb for locomotion. The lordosis is very slight.

In making a free selection from the large number of cases recorded among my notes, I wish to present two or three additional occurring in adult life wherein the results have been wonderfully good.

Case IV.—C. G., male, about twenty-five years of age, had been for many years, at least ten or fifteen, under the care of a very worthy member of our profession, and one whose results were second to none. This surgeon had conducted the case through all the stages of the disease, but there remained a high degree of deformity, which deformity was a great source of annoyance, and which interfered seriously with his education, and still later with a vocation in life.

At the time of operation, January 23, 1891, I had some misgivings lest the ether might not be well borne, but on finding his urine normal, I proceeded with the operation—a subcutaneous oste-

otomy. Prior to this, however, the measurements were taken, and it was found that he had about five inches practical shortening; that the trochanter was very prominent; that the angle of greatest extension was 120°, a very slight range of motion. He proved a most exasperating patient to manage, and it was necessary on the second day to remove the plaster and set the fractured limb again. A month later union was firm, and he had an inch and three-quarters shortening. A month later the angle of greatest extension was found to be 170°. During the succeeding six months he lost about 5°, but had gained in health and strength, had practically a straight limb, walked without a high shoe, and at last accounts, a year and a half after the operation, he was walking with great ease and was in excellent health.

Case V.—Miss A., about thirty years of age, presented a hideous gait, an extreme lordosis, wore a very high shoe, and walked with great difficulty. She had been an inmate of the Hospital for Ruptured and Crippled many years before, and had recovered with this deformity. Her angle of greatest extension at the time I made my observation, April 23, 1891, was 105°. There was about 15° adduction, five and a half inches shortening.

An osteotomy was done May 9, 1891, subcutaneously, and the limb brought to 165°. She suffered for two or three weeks subsequent to the operation from a distressing tympanites attended with vomiting. It was difficult to retain the limb in good position because of this complication. The plaster was removed June 12th. There was bony union. There was practically no shortening. She wore a jointed Dowse splint for several months, and my last observation was (March 16, 1893): "She has grown rather stout, walks remarkably well, presents very little lordosis, does not wear any high shoe, can walk long distances, and the result has surpassed our expectations."

Case VI.—B. R., a gentleman twenty-seven years of age, referred by Dr. William T. Bull, May 16, 1893. His angle of deformity was about 130°, with marked adduction. There was,

however, only one-half inch practical shortening and three-quarters of an inch real shortening.

On account of matters of expediency this gentleman insisted on the operation, which was done May 19th. In addition to the osteotomy the adductors were divided, and the limb brought to 180°. He suffered very little inconvenience from the plaster, did not wear a splint, but used crutches for a few weeks. My last note was July 10, 1893, when it was found that he had an angle of deformity of

FIG. 4.

Case VII. Showing deformity before operation.

about 165°. There was no difference, real or practical, in measurements. He writes under date of November 6, 1893:

"DEAR DR. GIBNEY: If you have any desire to see your handiwork, I should be very glad to drop in and see you any time in the afternoon that would be convenient. I am sure you have never

seen a fellow with an ankylosed hip-joint who could get around better than I. Yours sincerely, ———."

CASE VII.—F. K., a boy, six years of age, admitted to hospital July 28, 1891. Ability to extend his thigh to only 100°. The exact deformity is shown in Fig. 4.

FIG. 5.

Case VII. Showing final result.

Tenotomy failed to correct more than to 125°, and a few weeks later osteotomy was performed, and at the end of six weeks union was firm. The final result is show in Fig. 5.

CASE VIII.—Margery K., ten years of age, was an old case treated on the expectant plan, and discharged with limb in excellent position. At the end of two years, the splint having been removed

by the mother, she returned to the hospital, and her deformity is shown in Fig. 6.

She was put upon inclined plane with weight and pulley from November 7th to June 7th. The result was excellent, and in 1894

FIG. 6.

Case VIII. Showing deformity before treatment by traction.

she was found still wearing the Dow jointed splint; the position is shown in Fig. 7.

CASE IX.—Mary McE., thirteen years of age, admitted May 7, 1889, with deformity at 135°. The position of the limb and the bony prominence about the trochanter are shown to best advantage in Fig. 8.

An osteotomy was done on June 5th, and in September the position was as shown in Fig. 9. The girl has been under observation in the out-door department up to the present time, and while no

subsequent photograph has been taken, the result is about as shown in Fig. 9.

CASE X.—Carrie F., aged five and a half, was admitted November 3, 1893. She had never had any treatment. The angle of deformity is shown in Fig. 10.

FIG. 7.

Case VIII. Showing final result.

There was a division of the hamstrings, followed by the use of plaster-of-Paris for a few weeks, and then a long spring. Long subsequent to this date an abscess formed, the cicatrix of which is shown in Fig. 11. The good position was maintained throughout by apparatus, and at the time of her discharge, late in the spring of 1894, the position of the limbs is shown in Fig. 11.

CASE XI.—Robert Z., twelve years of age, presented on admission, June 30, 1891, a deformity as shown in Fig. 12.

The treatment was osteotomy, and the final result is shown in Figs. 13 and 14.

CASE XII.—M. K. This case is presented to illustrate a deformity of the hip due to disease, yet complicated with Pott's dis-

FIG. 8.

Case IX. Before an osteotomy.

ease of the spine. The kyphosis is not shown in Fig. 15, but the hip deformity is shown when the boy came into the hospital.

He was subjected to an osteotomy, and Fig. 16 shows a photograph taken two or three weeks afterward in order to illustrate the plaster-of-Paris bandage.

The final result was most excellent. This boy went to the far West, and reports have come from time to time that he continues straight and has no recurrence of deformity, so far as the parents can tell. He was treated at the hospital about four years ago.

Referring now more particularly to the analysis of the one hundred cases. The tables show the number of the cases, the age of the patient when treatment was begun, the time in the course of the

FIG. 9.

Case IX. Showing final result.

disease, or, more especially, the month or year from the inception of the disease. The next column notes the deformity. The next four columns give the method of treatment employed: *osteotomy*, which means always subcutaneous osteotomy; *force*—that is, manual force—under an anæsthetic, supplemented by the subcutaneous divi-

sion of tendon, fascia, or muscles; *the splint*—and by this is meant the portable apparatus which serves chiefly as a perineal crutch—very little traction being employed; and *weight and pulley* on inclined plane. The next column gives the interval between the result when the patient left the hospital and the date of the last

Fig. 10.

Case X. Before beginning of treatment.

observation when traced. Under the column "Result" is understood the final result, and the column "Net gain" explains itself. Under "Remarks" are included the presence of abscess, change in treatment, relapses, etc.

Summary.

Interval. There were 13 under six months; 23 under one year, including the six months' interval; 27 from twelve to eighteen

months; 35 between eighteen months and three years; and 2 over three years.

FIG. 11.

Case X. After treatment.

FIG. 12.

Case XI. Showing best position before treatment.

OSTEOTOMIES. There were 35 cases wherein osteotomies were performed: 10 were under the four-year limit, and 25 over the

FIG. 13.

Case XI. After treatment.

FIG. 14.

Case XI. After treatment.

four-year limit. Of the 10: 2 lost (1, 5°, 1, 10°), and in 1 there was no gain; 1 gained 5°, 1 gained 10°, 2 gained 25°, 1 gained 30°, 1 gained 40°, 1 gained 60°. Of the 25, 1 lost 10°. Of the remainder, 1 gained 20°, 2 gained 25°, 4 gained 30°, 5 gained 35°, 2 gained 40°, 2 gained 45°, 2 gained 50°, 1 gained 55°, 1 gained 65°, 1 gained 70°.

Fig. 15.

Case XII. Before treatment.

Force, Including Tenotomies, etc. There were 30 cases in which this was employed: 18 under the four-year limit, and 12 over the four-year limit. Of the 18, 1 lost 10°, 2 lost 15°, 1 lost 20°, 1 lost 30°, 1 no gain, 3 gained 10°, 2 gained 20°, 2 gained 25°, 1 gained 30°, 2 gained 35°, 1 gained 40°, 1 gained 85°. Of the 12, 1 lost 45°, 1 gained 5°, 3 gained 15°, 1 gained 20°, 1 gained 30°, 1 gained 40°, 2 gained 45°, 1 gained 50°, 1 gained 60°.

Splint. There were 18 subjected to the splint treatment: 17 were under the four-year limit, and 1 over the four-year limit. Of

the 17, 1 lost 5°, 3 lost 15°, 1 lost 20°, 1 lost 25°, 1 gained 0°, 3 gained 10°, 1 gained 15°, 4 gained 20°, 1 gained 25°, 1 gained 40°. Of the 1 over, 1 lost 15°.

FIG. 16.

Case XII. A few weeks after osteotomy, in the first dressing.

WEIGHT AND PULLEY. There were 17 subjected to this treatment: 9 were under the four-year limit, and 8 over the four-year limit. Of the 9, 2 lost 15°, 3 gained 20°, 1 gained 30°, 1 gained 55°, 1 gained 75°, 1 gained 85°. Of the 8, 1 lost 15°, 1 gained 0°, 3 gained 5°, 1 gained 15°, 2 gained 30°.

Two cases where force was employed developed acute symptoms, which resulted in abscess, and finally death at the end of a year.

The paper might be further illustrated by cases, and established by illustrations of peculiar deformities, but it is assumed that sufficient has been presented to justify the title of the paper.

The subjoined tables, with remarks, are presented to complete the paper.

Number.	Age (years).	Time.	Deformity.	Osteotomy.	Force.	Splint.	Weight and Pulley.	Interval.	Result.	Net gain.	Net loss.	Remarks.
1	5	8 mos.	85°	...	1	...	...	1½ yrs.	170°	85°	...	Abscess aspirated; cured; short Thomas.
2	4	1 year	130	...	...	1	...	2½ "	140	10	...	170° when discharged; relapse.
3	13	5 yrs.	130	1	...	...	...	1⅓ "	160	30	...	Caliper.
4	9	5½ "	110	1	...	...	...	.....	.....	...	...	Discharged.
5	10	6 mos.	135	...	...	1	...	7 mos.	175	40	...	Plaster-of-Paris, then splint; sinuses all closed.
6	7	4 yrs.	155	...	1	...	...	2 yrs.	110	...	45°	By force reduced from 135° to 165°; caliper.
7	4	1 year	150	...	...	1	...	1½ "	160	10	...	Weight and pulley, from 110° to 160°.
8	5½	3 mos.	160	...	...	1	...	1½ "	170	10	...	Abscess incised and healed.
9	6½	2 yrs.	140	...	...	1	...	2 "	140	...	...	Double hip; arthrotomy done; sinuses never closed.
10	14	5 "	165	...	1	...	...	.....	180	15	...	
11	6	17 mos.	165	...	...	1	...	11 mos.	180	15	...	Abscess incised and closed.
12	8	2½ yrs.	160	...	1	...	...	3 "	180	20	...	Reduced in three months to 165°.
13	12	4 mos.	130	...	1	...	...	2 yrs.	160	30	...	Wears splint; no pain nor tenderness.
14	12	5 yrs.	160	...	1	...	...	1 year	180	20	...	Went back to 165° in one year.
15	8	6 mos.	160	...	...	1	...	2 mos.	180	20	...	In one year relapsed to 140°; splint; deformity recurred to 140°.
16	10	2 "	145	1	...	...	...	1½ yrs.	140	...	5	Deformity reduced from 145° to 165° by operation; discharged with splint.
17	7	2⅓ yrs.	140	1	...	...	...	1½ "	180	40	...	Short Thomas and long splint.
18	7	3 mos.	160	...	1	...	...	1½ "	150	...	10	Deformity reduced from 160°–180°; discharged with splint; recurred to 160°.
19	9	3¼ yrs.	165	...	1	...	...	2 "	150	...	15	Deformity reduced from 165°–180°; discharged with splint; recurred to 150°.
20	12	2 "	160	...	...	...	1	1½ "	180	20	...	Deformity reduced in three weeks 150°–180°; short Thomas and splint.
21	...	.....	130	1	...	...	...	2 "	165	35	...	
22	12	12 mos.	155	...	1	...	...	3 "	180	25	...	Deformity by force and tenotomy reduced to 150°; caliper; discharged wearing a Dow; deformity reduced to 180°.
23	...	.....	145	...	1	...	...	2 "	145	...	...	M., force and tenotomy, 145°–175°; discharged with splint; relapse to 145°.
24	5¼	2 yrs.	120	...	1	...	...	2⅔ "	155	35	...	F., deformity reduced 120°–170°; abscess incised; healed; closed; discharged with splint; brace removed; deformity went to 155°.
25	7	7 "	120	1	...	...	...	4 "	160	40	...	Osteotomy reduced 120°–170°; recurrence to 160° in six months. (Read, M.) Weight and pulley, no gain; splint.
26	7	6 mos.	130	...	...	...	1	2½ "	160	30	...	Splint, deformed reduced by weight and pulley 130°–165°; recurrence with splint to 160°.
27	7	10 "	160	...	...	...	1	2¼ "	150	...	10	Weight and pulley, two months, 160°–180°; discharged wearing a Dow; recurrence to 150°.
28	10½	4 yrs.	150	...	...	...	1	3 "	180	30	...	Splint; splint removed; no recurrence in ten months.
29	7	9 mos.	155	...	...	...	1	2⅔ "	145	...	10	Weight and pulley, one month, 155°–170°.
30	6	1½ yrs.	170	...	...	1	...	2½ "	155	...	15	Splint, deformity reduced, 170°–180°; abscess disappeared after discharge; recurrence to 155°; wearing splint.
31	4	4 mos.	170	...	...	1	...	2½ "	145	...	25	Abscess aspirated, relieved; wears splint.
32	8	4 yrs.	145	...	...	...	1	1 year	175	30	...	Weight and pulley one month; reduced 145°–170°; abscess incised; arthrotomy; splint two months, deformity reduced to 180°; splint one month, recurrence to 150°.
33	8	4 "	155	...	...	1	...	2⅓ yrs	140	...	15	Deformity at 155°: not reduced in 3½ months.
34	...	.....	145	...	...	...	1	2 "	150	5	...	Weight and pulley, 145°–160°; discharged; no brace; relapsed 10°.
35	16	1 year	120	...	1	...	...	3 "	165	45	...	Private case.

Number.	Age (years).	Time.	Deformity.	Osteotomy	Force.	Splint.	Weight and pulley.	Interval.	Result.	Net gain.	Net loss.	Remarks.
36	10½	5⅔ yrs.	150	1	...	...	...	1⅓ yrs.	140°	...	10°	Osteotomy, deformity reduced to 150°; weight and pulley 1 month, reduced 165°; osteotomy again to 170°.
37	7	2 "	145	...	1	...	...	.....	155	10°	...	Weight and pulley five months, 145°–180°; abscess aspirated; in nine months deformity recurred to 155.
38	9	1½ "	115	...	...	...	...	.....	.....	...	...	Excision; died.
39	18	10 "	105	1	...	...	...	2 years	160	55	...	Osteotomy, deformity reduced, 105°–180°; recurrence two years later to 160°.
40	16	5 "	130	1	...	...	...	1 year	160	30	...	Private case.
41	7½	2 "	90	...	...	...	1	4 mos.	175	85	...	Deformity reduced 90°–175°
42	9	5 "	160	...	...	...	1	2 "	160	...	...	Weight and pulley in two months failed to reduce deformity.
43	9	1⅙ "	150	.	...	...	1	1 mo	175	25	...	Splint and Thomas.
44	10	3 mos.	160	...	...	...	1	1½ mos.	180	20	...	
45	10	5 yrs.	165	...	...	...	1	5 "	160	...	5	M., force and tenotomy, reduced 165°–175°; weight and pulley; deformity recurred to 160°; splint five months; deformity 160°.
46	5	3 "	150	1	...	...	...	1½ yrs.	175	25	...	Abscess opened; healed; osteotomy, 150°–175; recurrence to 165° after discharge; splint reduced 175°; no abscess.
47	6	1⅙ "	115	...	1	...	...	2 "	165	50	...	Force and tenotomy, 115°–170; recurrence in one month to 160°; no abscess; later sinus discharge; abscess re-established.
48	11	3½ "	155	...	1	...	...	1⅙ "	140	...	15	Weight and pulley, 155°–170°; caliper; splint and Thomas.
49	14	3 "	155	1	...	...	...	1½ "	160	5	...	Osteotomy, 155°–175; splint one month, recurrence to 165.
50	8	7 "	120	..	1	...	..	1 year	135	15	...	Force and tenotomy, 120°–165°; wears splint.
51	8	12 "	135	...	1	...	...	1 "	180	45	...	
52	6	3 "	120	1	...	...	...	1⅓ yrs.	147	27	...	Osteotomy, 120°–175°; although abscess; recurrence to 145.
53	30	25 "	105	1	...	...	...	2 "	165	60	...	Private case.
54	6	1 year	155	...	...	1	..	3⅓ "	140	...	15	Splint, 155°–175°; discharged with splint; recurrence to 140°.
55	4	.....	120	...	1	...	...	2 "	90	...	30	Deformity reduced, 120°–170°; splint; abscess; 90°.
56	20	16 yrs.	135	1	...	...	...	3 "	170	35	...	Private case.
57	4	.....	130	...	...	1	..	1½ "	125	...	5	Was excised at Roosevelt Hospital.
58	10	3 mos.	110	...	...	...	1	1⅔ "	165	55	...	Weight and pulley five weeks, 110°–180°; recurrence to 160° in two months.
59	9	1 year	155	...	...	1	...	1½ "	140	...	15	No treatment to reduce deformity; abscess later, then excision.
60	6½	.....	.....	...	...	...	...	.....	.....	...	...	
61	5	3 wks.	160	...	...	...	1	4 mos.	180	20	...	Thomas and long splint.
62	10	3½ yrs.	140	1	...	...	...	1½ yrs.	150	10	...	Weight and pulley, no result in five weeks; osteotomy; deformity reduced 140°–180°; discharged with short Thomas.
63	12	7 wks.	135	1	...	...	...	1½ "	170	35	...	Private case.
64	4	2⅙ yrs.	120	...	1	...	...	2½ "	100	...	20	Force, deformity reduced 120°–150°; discharged; no brace; recurrence to 100°
65	4	1 year	160	...	1	...	...	1 year	160	...	...	Force, deformity reduced 160°–180°; discharged with long splint; recurrence to 160°.
66	10	.....	.....	...	...	...	...	.....	.....	...	...	
67	12	6 yrs.	120	1	...	...	...	8 mos.	145	25	...	Osteotomy, 120°–170°; discharged with long splint and short Thomas; recurrence to 145°.
68	4½	2 "	150	...	1	...	...	3 yrs.	135	...	15	Weight and pulley three months, 150°–160°; caliper; recurrence to 135°.
69	5½	4 mos.	105	...	..	...	1	1⅓ "	180	75	...	Weight and pulley, 105°–170°; relapse; weight and pulley, 160°–170°; abscess aspirated; disappeared.
70	8	4 yrs.	100	...	1	...	...	6 mos.	160	60	...	Force, 100°–160°; weight and pulley 1½ months, 160°–175°; splint, three months, 175°–180°.

Number.	Age (years).	Time.	Deformity.	Osteotomy.	Force.	Splint.	Weight and Pulley.	Interval.	Result.	Net gain.	Net loss.	Remarks.
71	8	2 years	120	...	...	...	1	6 mos.	140°	20°	...	Splint and short Thomas; after discharge weight and pulley two months, deformity reduced 120°–160°; splint two weeks, 160°–165°.
72	16	8 "	140	1	...	...	...	7½ "	165	25	...	Osteotomy, 140°–170°.
73	6	3 "	100	1	...	...	...	7 "	160	60	...	Osteotomy, 100°–175°; splint four months, reduced to 180°.
74	27	20 "	130	1	...	...	...	1 year	165	35	...	Private case.
75	6¾	3 mos.	120	...	1	...	...	3 years	160	40	...	Force and tenotomy, 120°–165°; caliper, seven months, reduced to 180°.
76	10	9 "	130	1	...	...	...	10 mos.	130	...	...	Osteotomy, 130°–175; caliper; recurrence to 135° in six months; discharged with short Thomas; recurrence to 130°.
77	7	12 yrs.	130	1	...	...	...	10 "	160	30	...	Osteotomy, 130°–160°.
78	17	12 "	90	1	...	...	...	10 "	140	50	...	Osteotomy, 90°–165°; discharged with splint; recurrence to 140°.
79	8	2 "	150	...	1	...	...	10 "	160	10	...	Force and tenotomy, 150°–170°; discharge; caliper; relapse to 160°; wore nothing.
80	7	3 "	150	...	1	...	...	1 year	160	10	...	Force and tenotomy, 150°–170°: splint; recurrence to 160°.
81	9	6 "	150	...	...	...	1	1 "	165	15	...	Weight and pulley, 150°–160°; abscess during treatment not harmful; splint; 1 year; reduced, 160°–165°.
82	9	7 "	130	1	...	...	...	1 "	180	50	...	Osteotomy, 130°–180°; caliper one year; no recurrence; died of meningitis.
83	5	1½"	140	...	...	1	...	5 mos.	165	25	...	Splint; abscess incised; deformity reduced 140°–175°; recurrence, one month, to 150°.
84	4	6 mos.	150	...	...	...	1	5 "	180	30	...	Weight and pulley one month, 150°–175°; wore short Thomas six months, 175°–180°.
85	12	9 yrs.	145	...	1	...	...	6 "	150	5	...	Force and tenotomy, 145°–165°; splint and short Thomas.
86	4½	6 mos.	160	...	...	1	...	1⅔ yrs.	180	20	...	Deformity reduced, 160°–180°; no recurrence at end of three months.
87	7	4 yrs.	55	...	...	...	1	2⅔ "	160	5	...	Weight and pulley 1 week, 155°–170°; discharged with splint; recurrence to 135°. (Readmitted.) Abscess aspirated and disappeared; splint in hospital, 135°–160°.
88	4½	4 "	110	...	1	...	...	1 year	150	40	...	Died soon after discharge; force and tenotomy, 110°–150°; old abscess opened; excision of hip.
89	15	9 "	118	1	...	...	...	1½ "	160	40	...	Private case.
90	13¼	10 "	112	1	...	...	...	1 mo.	170	68	...	Osteotomy, 112°–170°; recurrence in one year; osteotomy again; recurrence to 165°.
91	8	3⅔"	145	1	...	...	...	2⅙ "	170	25	...	Osteotomy, 145°–170°; no recurrence in two years; hip splint.
92	8	6 "	90	1	...	...	...	2 mos.	155	65	...	Osteotomy, 90°–155°; discharged with hip splint.
93	10	6 "	130	1	..	...	...	4 "	175	45	...	Osteotomy, 130°–175°; discharged with hip splint; sinus discharged slightly.
94	6¼	8 "	160	...	...	...	1	49 days	165	5	...	Weight and pulley seven weeks, 160°–165°.
95	8½	.....	135	1	...	...	...	1 mo.	175	40	...	Osteotomy, 135°–175°; splint applied after removal of plaster-of-Paris.
96	21	16 "	.....	...	...	...	...	.....	.....	...	...	
97	5	3½"	145	...	...	...	1	6 mos.	165	20	...	Weight and pulley, 145°–165°; discharged with long splint.
98	6	3 "	150	1	...	...	...	2½ yrs.	140	...	...	Osteotomy, 150°–175°; discharged with splint; removed; relapse, 140°; abscess
99	11	2 "	160	...	1	...	...	3 "	180	20	...	Force and tenotomy, 160°–175°; in 1½ months discharged from hospital. (Readmitted.) In six months weight and pulley, 145°–170°; discharged with short Thomas 170°–180°.
100	22	14 "	120	1	...	...	...	1½ "	165	45	...	Private case.

DISCUSSION.

Dr. W. E. Wirt, of Cleveland, Ohio, said that he had been greatly interested in the subject, as he had seen a number of the cases operated on, and had followed the treatment for a certain length of time afterward. About two years ago, a case had come to him with flexion of the left limb, slightly less than a right angle, and also with recent hip-disease in the other limb. He felt that the first step should be to bring down the left leg, and then treat the more recent hip-disease by a walking-splint. Osteotomy as described by Dr. Gibney, had been done in this case, and the limb brought down to 165° with abduction. A plaster-of-Paris dressing was applied, and firm union occurred. The patient passed from under his observation for some time, and when next seen, after about six months, she was in the street walking nicely with the aid of a cane. The right leg being diseased also made the limbs about the same length after the operation. It seemed to him that this operation was exceedingly useful and capable of giving very satisfactory results.

Dr. S. Ketch, of New York City, referred to a case he had seen some years ago which he believed Dr. Gibney had also seen. The patient was a girl, who had been first seen with hip-disease when about five years of age. She had been under treatment for about two years with the long hip-splint, when the parents, thinking the disease cured, removed the splint without informing him that they had done so. She was then about ten years of age. He saw her again when she was about seventeen years old. She had been treated for several months for what was called rheumatism of the chest, the symptoms of which had been excruciating pains in the chest and abdomen. Examination showed well-marked Pott's disease, and on the side of the original disease there were acute symptoms of the disease, and also paraplegia. She was placed on an inclined-plane in bed. There was then about 140° flexion. Longitudinal traction was applied to the diseased hip and paraplegic leg. Finding that the longitudinal traction did not relieve the sensitive joint, lateral traction was also applied. The first thing noted was

an improvement in the paraplegia, and a coincident improvement in the flexion. He had seen her a few days ago, and a careful examination had shown slight flexion and an entire recovery from the paraplegia. She had not had any splint treatment since the time already referred to. She had now a perfectly useful limb.

He would also like to refer to the question of the use of force in the reduction of joint cases. He thought that Dr. Gibney's results showed that this was a dangerous method, and one by which the original disease was likely to be revived. In his opinion, it was a plan of treatment which should be abandoned.

Dr. Royal Whitman, of New York, said that he had inferred from Dr. Gibney's opening remarks that he was wavering in his belief as to whether it was proper to prevent deformities because it was so easy to correct them afterward. Dr. Gibney must be familiar with many cases in which no treatment had been employed, and in which the deformity consisted in adduction, flexion, and upward dislocation. Upward dislocation was a condition which could not be corrected even by operation. He believed that this was much more apt to take place when the deformity was allowed to persist. One of the first principles in treatment, in his opinion, was to prevent deformity. He felt sure that Dr. Gibney referred chiefly to a certain class of dispensary cases in his remarks upon the advisability of correcting these deformities as they occurred.

Dr. Ansel G. Cook, of Hartford, wished to report two cases—one of a boy twelve years of age, who recovered, and another, a girl of sixteen, who had had extreme deformity, leg flexed at a right angle, and being utterly impossible for her to touch the toe to the floor. He did the operation and she recovered without incident. He was sorry to find that she could not walk on the leg after it had been straightened. At the end of a year, however, she began to walk with a cane, and at the end of two years she was able to walk perfectly, without any crutch, and was able to attend to the duties of a hospital nurse.

Dr. A. J. Gillette, of St. Paul, asked if in these cases where there was a discharging sinus Dr. Gibney would operate for the existing deformity?

Dr. Gibney said he would not operate on a case where sinuses were discharging; he would wait for the sinuses to close, and would hasten this process by curetting them.

Regarding Dr. Whitman's remarks, he would say that he had entertained the impression for some time past that when these cases came with already existing deformity, and acute symptoms were present, and where he was satisfied that the disease had not been arrested, it was best not to correct the deformity in some cases; if force were employed in these cases it was liable to exaggerate the disease or cause the development of an abscess in some deep and inaccessible part. Here the question of excision came up, and one felt almost impelled to do this operation. He took it for granted that we were all endeavoring to avoid excision, yet there were many cases of deep femoral abscess where it seemed practically impossible to properly clean out these abscess cavities, and here he thought it wise to let them alone till the disease had spent itself, and then operate. He wished, however, to place himself on record as unalterably opposed to allowing deformity to develop in any stage of the disease. There were cases following the exanthematous diseases also, in which he preferred to let the disease run its course, if first seen after changes had occurred in the shaft and the neck, and where there was supposed to be an effusion of the neck and head with the acetabulum. Rather than disturb the focus of disease, he thought it wise to postpone operation for the time being.

He did not think the question of the effect of force was of special importance, and he certainly did not agree with Dr. Ketch that this method of treatment should be given up. There were many cases coming to the hospital with acute symptoms, to which no splint could be adjusted until the deformity had been corrected, and in which one could not make traction in the line of deformity except by traction upward toward the femur. In such cases, under primary anæsthesia induced by ether or nitrous oxide, one could partly draw down the limb and apply a plaster bandage for a few weeks until what damage done in this way had been repaired. The procedure could then be repeated, and the limb in this way prepared for further treatment.

There were other cases not reported, as they had not reached the our-year limit in which osteotomy had been done, and the patients

had left the hospital in good condition, but not sufficiently protected against the recurrence of disease. Some of these had returned to the hospital one or two years subsequently, and had had the joint excised. By studying these tables he had learned that certain precautions should be taken after the correction of the deformity, and particularly after osteotomy, and he believed the best method was the use of a short Thomas splint. The cases in which the deformity had remained corrected had been found to be those in which the short Thomas splint had been worn for some time after the operation.

Dr. A. M. Phelps, of New York, said that as a matter of fact, nearly all these cases with hip-joint disease coming to us with deformity in the first, second, or third stage, could be put into bed, and with a weight and pulley the deformity could be entirely overcome, whether there were abscesses or not. He would like to know whether he understood Dr. Gibney to say that they should be allowed to go on.

Dr. Gibney replied that he was in favor of overcoming the deformity with the weight and pulley in bed. He did not always succeed in preventing deformity, but he was in the habit of leaving the patient in bed until the patient or family objected very strongly to this treatment. He believed very firmly in the advantages to be derived in a very large proportion of these cases from rest in bed and the use of the weight and pulley.

QUESTION OF PRIORITY IN THE USE OF LATERAL TRACTION FOR THE RELIEF OF INTRA-ARTICULAR PRESSURE.

By A. M. PHELPS, M.D.,
NEW YORK.

The question of priority always dates from the time of publication; only for this it would be possible for valuable discoveries to be appropriated by others. The question of an individual's statement in regard to a matter without the proof of publication is absolutely invalid for the purpose of establishing priority. This is only fair to investigators, and it is fortunate that the scientific world recognizes this fact, otherwise great injustice might be done.

As regards the question of the application of lateral traction in hip-joint disease for the relief of intra-articular pressure and fixation, and the manner of its application, I believe I was the first to publish it.

In February, 1889, I read a paper before the New York State Medical Society on "The Management of Hip-joint Disease from an Anitomico-pathological Basis," which paper was published in the *Transactions* of the Society for that year. It was also published in the *New York Medical Record*, May 4, 1889.

In that paper I published drawings of my lateral-traction fixation splints, and also a plaster-of-Paris portable bed with lateral traction applied. I also explained the rule which should govern the application of extension or traction in hip-joint disease.

From that paper I quote page 313, *Transactions*, 1889:

"I fully agree with Sayre, Taylor, Barwell, Marsh, and others, that spasm of the muscles should be overcome by extension.

"I also fully agree with Thomas, of Liverpool, that every joint should be fixed and absolutely immobilized until all inflammatory

action has subsided and a cure effected; but I do not believe that immobilization of the joint can be accomplished without extension, neither do I agree with the first-named gentleman, that extension immobilizes a joint sufficiently to get the best possible result, but that the combination of the principles of fixation and extension should be the law. Hence, the long-traction splint, which admits of motion, does not immobilize, and the patient produces injury of the joint every time he steps upon it, as is evidenced in the vast majority of cases by the almost constant increase of the deformity after the splint is adjusted. Neither does a Thomas splint produce extension; hence, there must be abnormal intra-articular pressure when spasm or contraction of muscles is present, which must produce congestion of the head of the bone. And then, if extension is to be applied, it should be in the line opposite to the line of traction made by the muscles; in other words, to apply extension to the hip-joint, we should not only make traction in the line of deformity, but also in a line at right-angles to that deformity. To relieve perfectly intra-articular pressure, extension must be made in a line corresponding to the axis of the neck, and not with the axis of the shaft of the bone, for the following reasons:

"The adductors and abductors pass from the femur diagonally across the body to the pelvis, as Figs. 1 and 2 *Transactions* will demonstrate. These, with other muscles, are the ones affected by spasm. When they contract, the head of the bone is drawn firmly into the acetabulum, the force operating on a line corresponding to the axis of the neck. The flexors act on a line corresponding with the axis of the shaft."

Then follows a description of the plaster-of-Paris portable bed, with illustrations.

For the manner of applying lateral traction while the patient is in bed, to overcome deformity, and also of the splints which I devised for the purpose of carrying out this idea, see pages 316–320 of the *Transactions* of the same year.

So far as I have examined the literature upon this subject, this is the first paper printed that describes the application of the principle of lateral traction for the relief of intra-articular pressure and fixation in hip-joint disease. At the time I read this paper I was not aware that any one else had ever printed anything upon

the subject, and I find, upon looking over medical literature, that no one else has published the fact of the application of lateral traction for the purposes indicated before my paper of 1889. I have had made a brief translation of what has ever been said upon this subject by the German surgeons.

Med. Jahrbücher, 1873, Prof. Albert: "Die Extension bei Coxitis." "I was asked by Dumreicher to treat a large number of patients suffering from hip-disease, and to treat them without extension, and afterward to compare the methods with those treated by extension. I do not like to establish a rule when I say that without extension we can get along at least as well, and perhaps better, than with the extension. If extension really removed the pressure of the corresponding inflamed bones, then it might accomplish something. It is doubtful if the inflammatory process is retarded or improved through extension. And then, again, I must say that every method of extension that constantly changes the position of the intra-articular surfaces is wrong. This is sure, that through the new method intra-articular pressure is not relieved, but, on the contrary, more intra-articular pressure is induced.

"Busch proves conclusively that extension does not relieve intra-articular pressure, and rightly thinks that if extension is to be applied that it should be in the axis of the trochanter and not in the shaft of the bone.

He further thinks that "the pressure is also a remedy, as it stops the growth of the inflamed vegetations."

He further says: "Prof. Dumreicher has frequently said in his lectures that to relieve intra-articular pressure traction must be in two directions." But this was never applied nor published.

He further says: "I have seen cases where extension acted splendidly, when it was better than any other method, and if we were able to diagnose the pathological condition in the hip as we do in the knee I would not hesitate to apply it. . . . Severe pain might be due to pressure between the articular surfaces, and if extension were to be used to relieve pressure it could only do so by being made in the axis of the trochanter."

Further reference: Busch, 1863, *Langenbeck's Archives*, vol. iv.,

beginning page 50. Also vol. xiv., Czerny, *Wiener med. Wochenschrift*, 1869, No. 33 ff. Hüber, translated by Dr. Schepero.

So we see from this translation that lateral traction was not applied by either Albert, Busch, Dumreicher, or any other German. But they wrote in the strongest manner against any form of traction, and showed conclusively that if traction was to be applied it should be made in a line corresponding with the axis of the neck, and not with the shaft of the bone; but they make no mention of having applied it.

Wallace Blanchard, of Chicago, published an article in June, 1889, upon his apparatus for treating hip-joint disease, in which he attempts to make lateral traction. In his article he says: "It is beyond question that a really efficient apparatus for hip-joint disease must meet three requirements:

"1. It must afford traction outward as well as downward, so that the mean force exerted shall be in an axis with the neck of the femur, and thus relieve from pressure all the articular surfaces of the joint.

"2. It must afford immobility.

"3. And allow of unlimited out-of-door exercise, as far as pain or danger to the diseased joint is concerned."

But this was published after my article read before the State Society in February, 1889. In this article are diagrams which are similar to ones which I have used in teaching for more than ten years.

Sayre, in *Sajous' Annual*, 1890, vol. iii., gives Blanchard priority, and then he says: "We have done this for years with great satisfaction."

And then again in his article published in the *New York Medical Journal*, April 30, 1892, on "Results in Cases of Hip-joint Disease Treated by the Portable Traction Splint," he attempts to claim priority by publishing cases from his case-book.

It is needless for me to say that any statement made in the article in *Sajous' Annual*, or in the article referred to, April 30, 1892, would be absolutely worthless to establish priority. And further, in this article of April 30, 1892, I find the following statement:

"There has been considerable discussion as to priority in the application of lateral traction in hip-joint disease. I may say that

in looking over my notes I find that I applied it to L. A. McC. in 1868, in the presence of Dr. L. M. Yale.

If this statement was true, even though it had never been published, I would be willing to give to Dr. Sayre due credit for priority. This case-book to which he alludes was presented at the Academy of Medicine to prove priority, and I have made a copy of the notes of the case. Now I find that Dr. Sayre did not, in 1868 (according to his note-book above mentioned) apply lateral traction to L. A. McC. in 1868. The date is March 27, 1872, that he claims to have done it.

And then lateral traction for the purpose of relieving intra-articular pressure was not applied to L. A. McC. at any time, as this same note-book will prove: "A second weight was attached to the thigh by means of *adhesive plasters* in such manner as to *cause external rotation of the limb.*" This was a case of hip-joint disease in the third stage, *with extreme inward rotation,* and the *weights and pulleys were adjusted for the purpose of overcoming inward rotation, and not for the purpose of relieving intra-articular pressure,* as he claims. Then I think that the claim of Dr. Sayre to lateral traction *is entirely invalid, and will not bear examination.*

In his discussion of a paper which I read upon this subject before the Academy of Medicine, April 25, 1892, Dr. Sayre fully agreed that lateral traction and fixation was the law of treatment; that it was important that lateral traction should be applied, and claimed that he had always applied it.

I find, in looking over the last edition of his book, no mention of lateral traction. I find in his article of April 30, 1892, already quoted from, no mention of the application of lateral traction in any of his cases, excepting Case III, 1869, and Case IV, 1864, and the case which I have already quoted, in all 407. There is no mention of it since 1872, in the L. A. McC. case, when it was not applied.

Inasmuch as Blanchard and Sayre have mentioned their use of lateral-traction prior to the date of their publication, it would only be fair for me to make a statement.

From 1872 to the present time I have used lateral traction for the relief of intra-articular pressure in hip-joint disease. I have taught and applied the principle since 1874, as the note-books of

my students in the colleges where I have had the honor of teaching will demonstrate. I have applied lateral traction to the splints which I have used during all this period; but, as I said at the commencement of this article, these are simply statements, and count for nothing in the establishing of priority. Published statements are the data from which we are compelled to work.

I might further add that in the year 1884, by invitation of Dr. Schede in the Hamburg General Hospital, I put up many cases of hip-joint disease with lateral traction, as the records of that hospital will show.

I have written this article in a spirit of fairness, and I have devoted much time to looking up the subject, and my object is to place a landmark that can be referred to that will be perfectly authentic for students in the future who are desirous of exact data from which to work.

The following conclusions must be arrived at:

1. That in February, 1889, the first paper on the subject, demonstrating the application of *lateral traction for the treatment of disease of the hip-joint by relieving intra-articular pressure and fixing the joint*, was read by myself.

2. Following this, the paper of Blanchard, of Chicago, in the same year, in which *he gives me credit for priority of publication.*

3. That the case quoted by Dr. Sayre to establish a priority for himself *was not treated by lateral traction applied for the relief of intra-articular pressure of the joint.*

4. That the Germans referred to only mentioned lateral traction as an argument against the American idea of traction as applied in the long traction splint or by the weight and pulley, and that they publish no record of having applied it themselves, because they did not believe in any form of traction

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DISCUSSION.

Dr. A. M. Phelps, of New York, said that the only objection he could see to Dr. Blanchard's splint was that which also applied to Thomas' splint, viz.: that ending as it did at the calf of the leg,

it did not protect the limb, for it was well-known that dispensary patients would step on the foot. The splint should extend below the bottom of the foot. If the aim was to secure immobilization the splint should extend up onto the body and include a portion of the trunk; otherwise the hip-joint could not be fixed; in other respects he thought it was an excellent splint.

Dr. W. Blanchard explained that the thoracic band in his splint did come up to just below the axilla.

Dr. Benjamin Lee said that, without touching at all upon the question of priority of publication, he simply wished to say that in the hip-splint as used by Dr. Taylor and himself in 1862 he thought the necessity for lateral traction was present. (The speaker then drew a diagram on the blackboard to show that the perineal strap was attached as much to one side as possible, and that the combination of this and with the set-screw on the band showed that a certain amount of lateral traction was made.)

Dr. Whitman said he had no criticism to make on the principle of lateral traction, but much on the method of applying it in Dr. Phelps' splint. Dr. Phelps had shown one form of brace in which the opportunity for lateral traction was much greater than in the present form. He had examined all Dr. Phelps' cases exhibited by him and all coming under his own observation elsewhere, and he had not been able to convince himself that any lateral traction was made. The device which was supposed to make the lateral traction was nothing more than a strap or bandage about the leg, which would only hold the limb to the bar. The principle, he believed, was a good one, but the application of it in this apparatus seemed to him very ineffective.

Dr. Phelps said that the diagram made on the blackboard showed that abduction was produced and not lateral traction. The same principle was applied in the Taylor splint, and also by Dr. Sayre in his splint. Sayre claimed it as an abduction screw, and the speaker knew it made abduction rather than lateral traction. The cases which Dr. Whitman had seen him present at the Academy of Medicine de-

served his adverse criticism, but it should be remembered that these had come in a storm, and that there had been no effort made to apply lateral traction properly. Moreover, they were dispensary cases, and two or three workmen had been making the splints, so that many of the instruments were very imperfect. (Illustrating on the blackboard.) An extension force of only two or three pounds was required, because it operated on the long arm of the lever. The splint should be bent away from the thigh far enough to admit of lateral traction. In the other form of the splint, where there was a long bar inside and a short bar outside, the principle of action was exactly the same. The leg was buckled to the outside bar of the splint. In his opinion there was very little choice between the inside and the outside bar.

Dr. Weigel asked if traction were applied to the inside of the limb; in other words, to the soft parts, for he thought this would require an almost unbearable amount of pressure to be applied in order to get the direct effect on the bone itself; in other words, would not the traction-strap bury itself so deeply in the soft parts that but little effect could be exerted on the bone itself?

Dr. Phelps said that this same question had been raised in the course of a conversation with Dr. Ridlon. Dr. Ridlon had made a diagram to show that lateral traction increased intra-articular pressure, and he had certainly proved it by his diagram; but unfortunately lateral traction was not applied as he had drawn it in his diagram. In his diagram he had his perineal band close into the groin, drawing on the adductor muscle, and of course in this way increasing intra-articular pressure. But lateral traction should be made just above the knee-joint, and then it would relieve intra-articular pressure.

Dr. Weigel remarked that, as in that case pressure was so far away, he thought but little effect would be produced on the joint.

THE NEED OF REST IN THE TREATMENT OF HIP DISEASE.

By ROBERT W. LOVETT, M.D.,
BOSTON.

The object of this paper is to present upon some new and upon some old grounds a brief plea for the greatest obtainable rest to the joint in any treatment of hip disease, whatever it is, and to point out how this maximum amount of rest may be obtained. It will be sufficient to state that I am a believer in the use of strong traction in the treatment of hip disease, on the ground that it distracts the joint-surfaces; but that traction is in my opinion only a part of successful treatment. To some often-neglected factors I beg in the present paper to call attention, without discussing the general question of the treatment of the disease. The measures to be advocated are local and general. Among local measures the treatment of hip disease by the long traction-splint (the Davis, Taylor, Sayre splint) is probably the most common method now in use in America. Sometimes this is in connection with the use of crutches, but more often without them, the child being allowed to walk upon the splint, which thus becomes a perineal crutch Assuming what is generally allowed to be the case by all surgeons, that a diseased hip-joint should be protected from unnecessary jar and traumatism, it becomes of practical importance to inquire whether such traumatism occurs when a patient with hip disease is allowed to walk upon a traction-splint, or whether the traction-splint is sufficient protection to the diseased hip under these conditions. It may be seen when one observes a child with hip disease walking upon a long traction-splint that a slackening of the traction-straps occurs when weight is borne upon the diseased leg. The entire weight of the patient comes directly upon the perineal straps and the structure of the

splint, and tends to diminish traction every time that the bottom of the splint touches the ground. It is obvious that unless the apparatus is absolutely rigid from a mechanical point of view this must occur. Intermittent traction upon the hip must thus occur, the femur being allowed to slip back against the acetabulum when the patient's weight is borne upon the splint and traction is diminished. Leaving theoretic considerations, however, aside, the following experiments were undertaken to show what practical effect, if any, is produced when weight is borne upon the long traction-splint in walking.

Into the webbing of the ordinary hip-extension two small registering spring-balances were inserted, and the long traction-splint was applied in the usual way. Traction was then applied to the hip. The amount of traction was shown accurately by the balances, which formed part of the extension-straps through which traction was made upon the hip.

Experiment I.—Girl, six years old, with hip disease; traction of 7 pounds shown by balance; standing on splint reduced it to $5\frac{1}{2}$ pounds.

Experiment II.—Girl, ten years old, with hip disease of four years' duration; traction of 6 pounds; standing on splint reduced it to 5 pounds.

Experiment III.—Girl, eight years old, hip disease (slight); traction of 15 pounds; standing on splint reduced it to $8\frac{1}{2}$ pounds; walking lowered it to 7 pounds; after ten minutes without walking or standing traction had been lowered to 11 pounds.

Experiment IV.—Boy, six years old, hip disease of one year; traction of $18\frac{1}{2}$ pounds; standing on splint reduced it to $15\frac{3}{4}$ pounds; walking on splint reduced it to $11\frac{3}{4}$ pounds; after ten minutes traction had been lowered to $13\frac{1}{4}$ pounds.

Experiment V.—Boy, eight years old, hip disease for two years; traction of 18 pounds; standing on splint reduced it to 12 pounds; walking on splint reduced it to $9\frac{1}{2}$ pounds; after ten

minutes of walking and sitting the traction was reduced to 13½ pounds.

The experiments need very little comment. They simply show that at one time the head of the femur is pulled away from the acetabulum by a certain force, and the next minute by perhaps half that force. This intermittent pressure of the head of the femur against the acetabulum induced in this manner is in a smaller way the same process, so far as the hip is concerned, as walking upon the leg directly, a constant series of traumatic impacts being induced. This fact has often been alluded to, but has not, I think, been demonstrated by actual experiment.

Without entering into the merits of those splints, with the aid of which it is attempted to fix the hip-joint by rising above the pelvis and grasping the thorax by a rigid arm, it may be stated with regard to the long traction-splint that its use as a walking-splint cannot be otherwise than imperfect, compared to its use as an instrument to produce steady traction. That intermittent pressure exists is demonstrated; that intermittent pressure cannot do good, and may do harm, seems obvious. Some writers believe that motion of the hip-joint within small limits is beneficial during hip disease. None, however, could advocate on any scientific ground that a constantly varying traction-force could be of use. If this intermittent traction were a difficult matter to avoid it would not be worth while to spend so much time in its discussion; but the use of a pair of crutches and a high shoe on the well foot does away at once with the whole difficulty.

The matter of fixation has not been considered in this connection; the question has been purely one of traction.

As regards general measures, it may be said that hip disease is, in most cases at any rate, a tuberculosis of bone. Like many forms of local tuberculosis it is attended with general symptoms. Among the earliest in most cases may be sudden loss of flesh, failure of appetite, and high temperature. The latter is definite and easily studied, and as a symptom relating to the general condition of the patient is of interest in the present connection.

Some years ago I called attention to the significance of the importance of high temperature in chronic joint disease. At that

time I had not a very extended series of observations, but now I am able to generalize from some 1050 observations of the afternoon temperatures of children with hip disease and Pott's disease. For analysis there were taken from my notes at random records of 250 cases of hip disease. The temperatures were taken between three and five in the afternoon at the Surgical Out-patient Clinic of the Children's Hospital. The same thermometer was used, and every care was taken to make the observations accurate and uniform, the rectal temperature being observed. The observations on temperature in hip disease have covered a period of four years and are several hundred in number. They include routine cases taken as they came to the clinic, and no cases were omitted. The cases were under ambulatory traction treatment. In the group of 250 observations which were analyzed the temperatures were as follows:

Temperature between	Per cent.	Number of cases.
98° –98.9°	13.6	34
99° –99.4°	26	65
99.5° –99.9°	18	45
100° –100.9°	33	84
101° –101.9°	7.2	18
102° –103	1.6	4

Studying the temperature as applied to individual cases there was no question that in severe cases the temperatures were higher than in mild ones. As a prognostic indication the temperature was of much use in the early stages, because, as a rule, cases which later proved to be severe began with a temperature of 100° or more. On the contrary, cases with a mild initial temperature as a rule did well. The occurrence of a sudden rise of temperature in a convalescent case often indicated an approaching relapse. In general, the severer the case the higher the temperature. High temperature is an early symptom coincident with the initial muscular spasm.

But what is of especial interest in this connection is the fact that the temperature in the evening is lowered in most cases by confinement to bed. It has been demonstrated very often in my experience that a child attending the out-patient department has had for weeks a temperature in the afternoon of 100° or more, but that when deformity or other symptoms which necessitated confinement to bed have arisen the temperature has fallen to normal or to 99° within forty-eight hours after confinement to bed. All, I am sure,

will agree that in routine hip disease without active suppuration a high temperature is not often to be seen in hospital wards. A similar series of charts in an out-patient department would show a noticeable rise of temperature in the great majority of all cases, mild and severe.

In the same way a restriction of the child's activity by enforcing periods of recumbency during the day will in most cases lower the temperature, although generally not to the normal. I have observed this repeatedly, and more often of late when I have been adopting this limitation of activity as a routine measure in all but the mildest cases. Unfortunately, the routine observations of temperature were abandoned some time ago, so that no extended series of figures bearing upon this subject can be given.

Putting aside, however, the demonstrable fact that this subsidence of temperature does occur under recumbency, as shown in the observations already quoted, the benefits of restricted activity can be called to the attention in another way by noting how often it is that patients with tuberculous bone disease who are being treated by ambulatory methods improve temporarily in flesh, appetite, and spirits when confined wholly or partly to bed.

Although as far removed as anyone from wishing to advocate the treatment of hip disease by recumbency, I would beg to call attention to the conclusions to be drawn from the facts presented in favor of restricted activity, on the ground that high evening temperature is present in nearly all cases of tuberculous hip-joint disease, and that this high temperature is in most cases diminished by partial recumbency. The system that I direct as a routine in mild cases is very simple. The child stays in bed until nine or ten o'clock in the morning. An hour's rest on the back is insisted upon during the morning and two hours of recumbency in the afternoon. The child goes to bed early in the evening, generally at seven. For severe cases longer periods of rest would be prescribed. No ambulatory apparatus is perfect, and it is obvious on general principles that a child with hip-disease cannot without harm indulge in the incessant activity of other children.

The measures that I advocate in connection with any treatment, whatever it may be, are the routine use of crutches and a shortening of the active period of the day, both of which should be adopted for the purpose of securing increased rest to the joint.

A SPLINT FOR HIP DISEASE.

With Remarks on Mechanical Treatment.

By WALLACE BLANCHARD, M.D.,
CHICAGO.

The splint here offered for your inspection is presented as embodying certain therapeutic requirements in the treatment of hip disease. I have called it a Conformidable Anti-friction Hip Splint, and have used it with excellent success for twenty-two years. Probably a fair definition of an anti-friction splint would be one intended to approximately secure fixation of the hip and at the same time exert a traction force outward and downward in an axis with the neck of the femur, to, as evenly as may be, relieve the pressure of the head of the femur in the acetabulum.

I believe that the same general rules govern the pathological progress and cure of chronic joint disease, whether it be morbus coxalgia, "Pott's disease" of the spine, or disease of other movable articulation. Any one of these beginning as traumatic, strumous, or syphilitic, usually soon becomes tubercular. The general tendency is toward destruction of one, at least, of the presenting surfaces of the articulation, with accompanying pain, prostration, and more or less distressing deformity. In every one of these diseases friction, if it does not kindle inflammation, increases it, grinds down the inflamed osseous structure into detritus, and destroys reparative tissue more rapidly than it can be produced.

If this be true, then it necessarily follows that the most successful treatment must be that which relieves both movement and pressure, the two factors of friction, to the best possible advantage. Of course, perfect immobility of the hip-joint cannot be secured, except by apparatus that secures both sides of the body, both hips and both legs; but there has long ceased to be any doubt that immobility for all practical purposes is secured by any well-fastened,

immovable, and inflexible splint that extends from the lower angle of the scapula to the lower border of the calf of the leg on the diseased side, and by means of which movement can be reduced to two or three degrees, and even that can be retarded and the leg of the well side at the same time be left free for use for the exercise both in and out of doors, that, in my experience, is absolutely necessary for recovery in a large majority of cases. So much for the movement in the joint. Now as to the pressure.

I notice that many writers, when speaking of the value of traction in hip disease, refer only to longitudinal traction, which can only impinge the head of the femur more firmly into the acetabulum, and in my opinion is of but little value as a therapeutic measure. In speaking of traction I wish to be understood as referring only to that made in an axis with the neck of the femur. That traction does distract would seem to be as nearly settled as most any question in orthopedic surgery, by the experiments of König (*Zeitschrift f. Chirurgie*, 1873); Brackett (TRANS. AMER. ORTHOPEDIC ASSOC., vol. ii.), and Bradford (TRANS. AMER. ORTHOPEDIC ASSOC., vol. v.), and many others perhaps as well known.

Now that it is satisfactorily proven that distraction does distract, many eminent observers in this direction seem to desire nothing further as a therapeutic agent, while those who employ Mr. Hugh Owen Thomas' method regard immobilization as entirely sufficient. That both are efficacious is undoubtedly proven by prolonged clinical experience. And since it is as much of a physical impossibility to have an immobilization that is absolute and perpetual as it is to have a distraction that distracts perpetually and absolutely, why not get the advantage of both? And what is distraction but the relief of pressure? And what is immobilization but the inhabitation of movement? Then, why should not the relief of both movement and pressure, the two factors of friction, be the ideal treatment?

The splint here presented I applied on patients in Dr. Edmund Andrews'[1] wards, in Mercy Hospital, Chicago, in 1872, three

[1] The following letter from my respected friend and preceptor, Dr. Edmund Andrews, surgeon-in-chief to Mercy Hospital and an honorary member of this Association will explain itself:

WALLACE BLANCHARD, M.D.: In the spring of 1872 you applied in my wards in the Mercy Hospital the strip iron hip-splint with high shoe and crutches, the object being to immobi-

years before Mr. Hugh Owen Thomas published the first edition of his book on the *Hip-, Knee-, and Ankle-Joints.* I hope, therefore, I will not be charged with making an infringement on Mr. Thomas' splint.

In fitting this splint the patient should stand with the foot of the diseased side blocked up until the pelvis is level, then a strip of soft wagonmaker's iron, known as binding, three-fourths of an inch by three-sixteenths for a child, to extend from the lower angle of the scapula down over the back, thigh, and leg on the affected side until within two inches of the heel, is bent by wrenches to the exact form of the body. To the upper end of this upright is to be riveted a thoracic band, using iron five-eighths by one-eighth, with two-thirds of its length on the unaffected side, and bent oval to the form of the body. A strip of the same iron is to placed in the position of a band to reach two-thirds around the leg at a level with the upper margin of the patella, and a like band at the lower end of the upright to extend two-thirds around the ankle at a level with the upper margin of the maleoli. These bands are all secured with straps and buckles in front. A short strip of the same iron is riveted to the upright and bent oval to a position necessary to support a disk of firm saddler's leather, three inches in diameter; the lower third of which is to rest on the anterior superior spine of the ilium. From this pad, extending downward to the outside of the knee-band, is a strip of the same iron, bent so as not to be nearer than two inches to the outer side of the thigh at any point. The lower end of this outside upright is a sliding joint which permits of the angle of the main upright being changed at the pleasure of the surgeon. To each side of the lower ankle hoop is attached a buckle for the accomplishment of longitudinal traction by means of adhesive plaster applied to the leg. The counter longitudinal traction is presented by a couple of loops of leather extending from the thoracic band to a tight leather waist belt. From the outside bar,

lize the hip-joint. This splint was substantially the same as brought before the profession three years later by Mr. Hugh Owen Thomas, of Liverpool, in his book (first edition), in 1875. I do not suppose that Mr. Thomas consciously derived his plan from yours, but rather that, having the same disease to treat and the same indications to fulfil, he devised a similar apparatus without knowing that it was already in use in Chicago. In the spring of 1872 you added to your splint an arrangement for making both longitudinal and lateral extension, and applied the same in my wards. EDMUND ANDREWS.

with its upper end resting on the crest of the ilium and its lower end on the outside of the knee-band, is attached a wide, soft-padded band passing around inside the thigh, by means of which all the lateral and slightly forward traction which the patient will tolerate comfortably is exerted. The power of both tensions being equal, the mean traction will be seen to be in an axis with the neck of the

FIG. 1.

The patient with splint adjusted.

femur. The main strip down the back, thigh, and leg secures nearly complete immobility, and I have come to look at this as almost necessary as in fractures. The surface of the splint next to the body is padded, and the whole instrument is covered with sheep-skin. A patten or cork sole is placed under the foot of the unaffected side of such thickness as to prevent the other foot from touching the floor. The patient is given a pair of crutches and

told to take all the exercise in the open air that his general condition will permit. The splint should be moulded perfectly to the form and be painless to wear, or it has not been properly applied. It is just as much a bed splint as a walking splint, and should never be removed, except for changes or repairs. The joint is now protected from jar or concussion, and both factors of friction are largely overcome. As the muscular spasm subsides and the flexed leg falls into the natural line of the body the upright section of the splint should be shaped so as to conform to the improved position. In the ordinary or painful form of hip disease, in which spasm is a prominent symptom and exacerbations are common, with the leg flexed and muscular spasm so firm as to fix the femur with a rigidity that often simulates a bony ankylosis, it is quite the usual thing to find, after the second or third day of wearing the splint above described, that the patient is sleeping well; that the night cries have ceased, and that all involuntary (or reflex) spasm has subsided, the leg hanging in a normal position and the patient making no complaint of pain whatever, and remaining in this most pleasing condition to both the surgeon and patient for the whole period that it is necessary to wear the splint to effect a cure.

Case I.—Owen H., aged six years, was admitted to the Home for Destitute Crippled Children, Chicago, February 20, 1894. Diagnosis, hip disease; duration, one year. For three months previous to admission was kept on the bed with longitudinal weight and pulley extension at the Presbyterian Hospital. Right leg normal, left leg immovable, flexion 50°, abduction 15°, eversion 15°, no abscess; thickening of left hip-joint. Immediately after his admission to the Home, Dr. F. S. Coolidge took this patient before the class of the Post-graduate Medical School, and the muscular rigidity was so great that the entire class pronounced it a case of bony ankylosis of the hip-joint. Pain throughout the left leg down the back of the affected side was intense, and night cries continuous.

March 28th, Blanchard's hip splint was applied. On the fourth day of wearing the splint the muscular spasm had entirely subsided. The position of the leg was normal, and the patient had ceased to complain of pain. On the sixth day the nurse reported that the night cries had subsided entirely; that the patient slept well and

gained a good appetite. At this date the patient is still improving, and is out of doors every pleasant day. My experience is that at least eighty per cent. of all cases taken in the first stage should make good recoveries without ankylosis or deformity, and of the other twenty per cent. that drift into the suppurative stage (because, perhaps, most of them had developed purulent degeneration in the joint before receiving any treatment whatever), from fifteen to eighteen should still make good recoveries; and, in fact, I have frequently been surprised at the rapid recovery without ankylosis and with slight or no deformity of cases taken after they had advanced well into the suppurative stage.

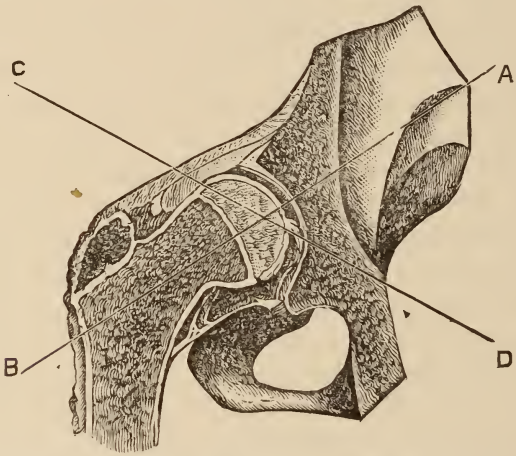
Of course, we occasionally see the destructive form, which is rapid, severe, and but little influenced by treatment, in which a removal of dead bone, or perhaps an excision, is the only advisable course, but they are certainly not more than 3 or 4 per cent. of all the cases I have seen. And yet it is the practice of many of our general surgeons in the West to excise the head immediately that the diagnosis is made "to save time," or at most the patient is laid on the bed with a weight and pulley longitudinal extension, or a plaster-of-Paris bandage is applied over the side and thigh with the only apparent intention of taking up time till the patient or his friends consent to an excision. Much of this apparent apathy is due to the fact that the operator is able invariably to draw down the two feet together after an excision and show that the leg has only been shortened a half inch or so, closing his eyes to the fact that in a few months, if he has a fairly good result, his patient will be walking with his weight pushing the stump end of the femur up until the leg is shortened four to eight inches. Humanity demands that this indiscriminate sacrifice should cease.

A few years ago Dr. A. M. Phelps, of New York, originated a splint to as far as possible "absolutely immobilize the hip-joint; secondly, to relieve intra-articular pressure." The same gentleman closes a paper (TRANS. AMER. ORTHOPÆDIC ASSOC., vol. v.) on the etiology of the various deformities of hip disease, showing long and laborious research into the varying conditions and relations in health and disease, of the muscles surrounding this joint with these words: "The reader at once asks the question—'Why all this work? What good can come of it?' I will briefly answer: In the treatment

of hip-joint disease fixation to prevent motion, and extension to overcome intra-articular pressure, is the law of treatment." And "that to relieve intra-articular pressure by overcoming the contraction of the muscles, traction should be made in the line of the axis of the neck and not of the shaft." I believe these statements of Dr. Phelps to be as incontrovertible as they are vigorous.

Dr. E. H. Bradford says (TRANS. AMER. ORTHOPEDIC ASSOC., vol. v.): "Slight motion, if all intra-articular pressure were removed, would not be as injurious as the exaggerated constant articular pressure without motion," and "an articular bone surface freed from pressure heals as is seen in cases of amputation at the hip, where a carious acetabulum will be seen to cicatrize entirely."

FIG. 2.



Vertical section through hip-joint of a child, from *The Hip and Its Diseases*, by Dr. V. P. Gibney (after Morris).

A to B indicates the direction of traction necessary to relieve pressure in the socket. C and D indicate the direction in which the head is carried by traction in an axis with the shaft of the femur, aided by the femoro-pelvic muscles.

The weight of pathological data seems to me to be in the same direction as that just quoted, and certainly indicates that as nearly absolute and unremitting relief of friction as possible is a necessary therapeutic measure.

It is my observation, covering a period of more than twenty years, and of over two hundred cases, many of whom have been in my splint for from two to four years, that the more prolonged the

traction and fixation the less the likelihood of bony ankylosis or deformity, and Dr. Phelps says, speaking of prolonged fixation and traction (TRANS. AMER. ORTHOPEDIC ASSOC., vol. v.): "No case need recover with bony ankylosis or angular deformity," and that is certainly my experience.

My patients sit very well on the side of a chair, with the fixed leg hanging over, and I never hear complaints of special discomfort in that regard.

Till the spasm has subsided from fifteen to twenty pounds of tension should be maintained, and after that eight to nine pounds is all that is usually necessary on a child.

I have occasionally attached spring scales at the four points from which traction power is exerted on this splint, to graduate the amount of tension used. When that is done it should not be forgotten that about one-third of the traction force is lost in the division of directions.

Confining the patient to the bed with a longitudinal weight and pulley extension for weeks and months at a time seems like a relic of barbarism, and is sufficient in itself to ruin the health of an otherwise well person. If there are cases benefited by that practice I have not seen them.

In conclusion, there are several points that seem in the light of my experience very clear:

1. It is friction that destroys the delicate new tissues of repair more rapidly than Nature can provide them.

2. As friction is relieved so proportionately are the chances of deformity or ankylosis reduced.

3. To relieve friction, traction is just as necessary as fixation, and fixation is just as necessary as traction.

4. From fifteen to twenty pounds of distractive force is necessary for the first few days till the pain and spasm subside, and after that from eight to ten pounds distracts sufficiently for all practical purposes of treatment.

5. While there are, perhaps, occasional cases that rebel against distraction, and other rare cases that contra-indicate immobilization, such cases are so seldom met with that they do not affect these general conclusions.

6. Traction prevents jar and concussion in the socket.

7. Traction to overcome muscular spasm to the best advantage, and at the same time relieve pressure in the joint, must be exerted in an axis with the neck of the femur.

8. With proper attention in a given case, improvement will generally be in proportion as movement and pressure, the two factors of friction, are relieved.

Seldom, indeed, will a recovered case be found with angular deformity or bony ankylosis if these indications are fulfilled.

LATERAL TRACTION IN HIP DISEASE.

By CALVIN GATES PAGE, M.D.,
BOSTON.

Lateral traction was applied to the following eight cases at the Children's Hospital in order to throw some light on these problems in traction suggested by Dr. Bradford. By his kindness and that of Dr. Burrell, I am able to add notes on three cases treated at the Boston City Hospital.

Problem 1. Are there cases which are distinctly relieved by lateral traction, and by what weight?

Problem 2. Are cases more comfortable with lateral traction alone, without, in addition, longitudinal traction?

Problem 3. What are the limits of weights in lateral traction?

Problem 4. Is the limit of longitudinal traction, gradually applied and increased, the tension on the skin—provided the limb is so placed as not to pull on the stretched Y-ligament or contracted muscles, and that the limb be not adducted?

The method of application is shown in Fig. 1. Longitudinal traction is obtained by a weight and pulley at the foot of the bed. The cord is tied to the middle of the wooden cross-piece or spreader, which in turn is buckled on to the straps of adhesive plaster. The foot of the bed should be raised to give counter-extension. The patient lies on a Bradford frame with shoulders strapped down. The frame should be as wide as the hips, should extend four inches above the head and as much below the feet for a child, though it may be considerably shorter if more convenient.

It is firmly padded with canvas with a space opposite the buttocks to allow for the use of the bed-pan without disturbing the child. It is best made of one-quarter inch galvanized iron gas-

pipe. A folded towel pinned about the knees, and another about the hips, ordinarily give sufficient fixation.

Fig. 1.

From photograph of Case VII. Pulley and weights at foot of bed not shown.

Fig. 2.

From photograph of Case IX.

Lateral traction is obtained by a band of canton flannel (or linen) passed about the thigh as close to the groin as possible and attached to a weight over the side of the bed. Counter-traction is

made by a similar band about the pelvis, fastened to the other side of the frame or to a weight, as shown in Figs. 1 and 2. The ankle is held by a sand-bag to prevent abduction.

At the Boston City Hospital a side pulley is used so that the cord does not press on the mattress. (Fig. 2.)

In order to test the amount of lateral traction a child can bear I made use of a short, steel upright clamped on to the side of the frame. Through the top of the upright an octagonal bar was fitted to slide freely. By means of a thread cut on the bar it could be drawn through the upright by turning a thumb-screw. The upright was made adjustable so that the bar could be moved in any desired direction. (Fig. 3.)

A spring balance was hooked on to the bar and the other end passed through the thigh band. The bar was gradually shortened by the thumb-screw and the band pulled tight. With a frame

Fig. 3.

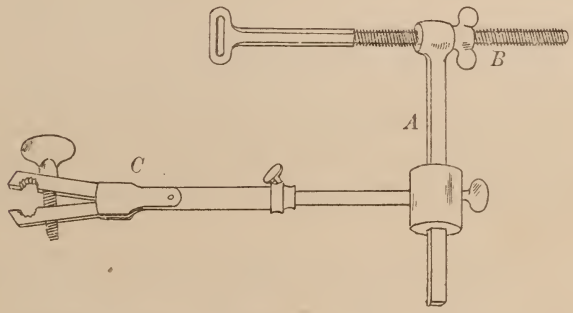


Diagram of lateral-traction apparatus clamped on side of frame, with band around thigh.

several inches too wide the pelvis could be fixed close to the further side, leaving plenty of room for the stretching of the band and the spring, and the yielding of the thigh. By simply tightening or loosening the screw it was possible to vary the tension at will.

Case I. *March* 7, 1894.—John C., aged six and a half years; double hip disease; right, eighteen months; left, eleven months; hips sensitive, but no night cries.

10*th*. Longitudinal traction increased to five pounds each.

15*th*. Lateral traction three pounds each. Patient more comfortable.

17*th.* Lateral traction omitted for several hours twice; each time patient asked to have it reapplied.

23*d.* End weights (fifteen pounds each) omitted. Lateral three pounds each, and sand-bags to prevent abduction. Two hours later no pain, but not so comfortable.

24*th.* No pain or night cries; leg adducted; end weights reapplied after being off twenty-four hours; is more comforable.

April 8. Has continued with three pounds lateral weight and four pounds end weight. Motion increasing in both hips; not sensitive.

10*th.* Lateral weights omitted now without discomfort.

In this case lateral traction made patient more comfortable. Omitting end weight caused discomfort.

CASE II. *March* 5, 1894.—Maggie J., aged five years; right hip disease, eight months; moderately sensitive; longitudinal weight three pounds; lateral weights applied. Test for few minutes with screw: three and a half pounds, no discomfort; four and a half pounds caused pain. Lateral weight omitted for a few hours at a time; more comfortable when reapplied.

23*d.* Lateral weight, two pounds; end weight omitted.

24*th.* Cried twice last night; says he wants end weight off.

27*th.* End weight has been off three days; lateral weight, two pounds; seventeen cries last night; end weight three pounds, reapplied.

28*th.* Cried eight times; end weight increased to four pounds.

29*th.* Cried fourteen times; end weight increased to six pounds.

30*th.* Cried only four times; lateral weight increased to three pounds.

31*st.* No cries; lateral weight omitted.

April 2. Has had no cries; splint applied in daytime.

8*th.* Up in chair; learning to use crutches.

Applied extra long Taylor splint in bed, with spreader and spring balance tension, nine and a half pounds; in evening, eight and a half pounds. Next morning, eight pounds; later, six pounds. Adhesive plaster extension had pulled down one-half inch.

This case was more sensitive after omitting end weight.

CASE III.—Arthur L., aged eight years; hip disease three years. Some subluxation and permanent flexion; lateral weight,

one and a half pounds: Test with screw up to four pounds without pain.

March 23*d.* End weight omitted; lateral traction with screw up to four pounds; no pain.

Straps loosened during night and weight diminished.

26*th.* End weight reapplied after two days; no result; lateral weight omitted.

Hip has not been sensitive at any time.

April 8. Some flexion still remains; not sensitive.

This case could bear lateral test up to four pounds.

Omitting end weight gave no advantage.

CASE IV.—*March* 13. Mary D., aged four years; hip disease, seven months. In hospital before; returns sensitive, and twenty degrees flexion; night cries; longitudinal traction three pounds.

17*th.* Lateral weight two pounds; night cries worse.

19*th.* Lateral weight omitted; cries ceased.

20*th.* Night cries again; end weight increased to five pounds.

24*th.* No cries since.

Lateral traction apparently made cries more frequent. Relieved by increasing longitudinal traction.

CASE V. *March* 12, 1894.—Deborah Y., aged five years; hip disease, one year. In hospital before; old splint; hip sensitive for three weeks; very sensitive on entrance. Lateral test with screw caused pain, when only two and a half pounds at first; lateral weights one and a half pounds; no advantage noted.

23*d.* Hip less sensitive; lateral weights continued.

24*th.* Lateral weight omitted; end weight three pounds.

April 8. Hip has continued sensitive, but no night cries; splint applied in daytime; hip chair.

12*th.* Extra long Taylor splint applied in bed, with spreader and spring balance; tension three and a half pounds cause pain at first, later increased to four and a half pounds.

13*th.* Tension remains about four pounds; increased to five pounds.

14*th.* Tension has remained five pounds for twenty-four hours; skin reddened by perineal bands; splint omitted.

Later. Hip has been more sensitive; end weight increased and lateral weights worn with comfort.

This sensitive hip could not bear much lateral traction.

CASE VI.—Elsie S., aged three years. Acute symptoms, two months; possible duration, two years; sensitive hip; marked flexion. Incline plane. Flexion gradually diminished (four weeks).

March 11. After flexion had gone lateral weight applied, with apparent benefit. Lateral weight omitted.

17*th.* Splint applied during day; night cries.

23*d.* Hip still sensitive; sits up and walks some with high sole and crutches.

26*th.* Cried several times with pain in leg; end weight increased to eight pounds.

28*th.* Cried out three times; lateral weight two pounds at night.

April 8. No cries since, and hip less sensitive.

Here was marked benefit from lateral traction at night.

CASE VII. *March* 5, 1894.—Allen W., aged six years. Acute hip disease. Less sensitive after a few days' longitudinal traction.

8*th.* Lateral weight one and one-half pounds; when omitted at intervals the patient was glad to have them replaced; test with screw and spring balance showed that four and one-half pounds could be borne for a few minutes without pain; when increased, there was pain, due to pressure of strap on skin; lateral weight continued.

17*th.* Longitudinal weight increased to five pounds.

24*th.* Longitudinal weight increased to seven pounds.

April 8. Has continued with seven pounds end, and lateral one and one-half pounds; no cries; not sensitive.

12*th.* Plaster has caused excoriation; now wearing stocking extension; extra long Taylor splint in bed; spring balance, six and one-half pounds, caused stocking extension to slip. Reapplied nine pounds; slipped down to seven pounds. One-half hour later six and one-half pounds; increased to seven and one-half pounds. At end of one hour complained of pain in perineal band; loosened and remained comfortable at four pounds.

Lateral traction apparently made this patient more comfortable.

CASE VIII. *March* 17, 1894.—Minnie K., aged seven years. Acute recent hip disease. Duration six months (?). Pain in knee four weeks. Marked abduction and outward rotation. End weight four pounds; no night cries. Lateral traction one and one-half pounds.

23*d*. Some motion; can be brought into better position. Lateral test with screw and spring balance for two days. Seven pounds could be borne without pain. Owing to slight change of position or stretching of straps there remained, after a time, only three or four pounds tension.

As there were no night cries and little sensitiveness lateral traction was omitted.

This case could bear seven pounds lateral; three to four pounds comfortable.

CASE IX. (Boston Children's Hospital). *January* 16, 1894.—Rachael E. S., aged nineteen years, married, housewife. Pain in knee and thigh for three weeks. Flexion and abduction; no motion. Traction for five weeks.

February 20. Traction omitted; up.

March 4. Pain in hip again; traction reapplied.

18*th*. Considerable pain.

30*th*. Worse pain; loses sleep.

April 5. Fracture bed; pain in hip and groin.

7*th*. Severe pain in back.

10*th*. Side pulley put on leg, over thigh near perineum; makes leg more comfortable.

13*th*. Lateral traction increased to ten pounds; patient continues more comfortable.

20*th*. Lateral traction continued; patient has had less pain of late; leg kept fully extended; extension thirteen pounds; lateral traction eight pounds.

25*th*. No pain in hip except when weights are disturbed.

May 27. Has had relatively little pain; weights changed to give best results. Just now extension eighteen and lateral three pounds. To have splint soon.

This case had very marked pain, requiring morphine and a fracture bed. Relief from lateral traction immediate and permanent.

CASE X. (Boston Children's Hospital, vol. ccxxxvii. p. 212). *January* 31, 1894.—Bridget N.; hip disease two months; right thigh adducted. Luxation head of femur; swollen, tender, and sensitive.

February 4. Extension three pounds.

8*th*. Pain; morphine to reduce pain.

17*th.* Improving; little pain.

27*th.* Leg gradually being straightened; slight amount of pain.

March 4. Fifteen pounds extension; some pain.

11*th.* Leg almost straight.

27*th.* Right leg one-half inch shorter than left.

April 10. Canvas stocking, uncomfortable; extension ten pounds; pain on motion.

22*d.* Extension ten pounds; lateral traction five pounds.

29*th.* No redness, swelling, or tenderness about hip; no pain. Weights continued; measured for splint.

May 27. Has continued without pain and improving. Weights as before, except extension temporarily reduced to five pounds; can turn onto left side.

Acute symptoms subsided before lateral traction was applied.

CASE XI. (Boston Children's Hospital, vol. ccxxxix. p. 234). *March* 20) 1894.—Sadie J., aged seventeen years, table girl; fell, striking right hip, ten days ago; marked pain; rest in bed.

28*th.* Improved by rest; extension three pounds applied.

30*th.* Little pain.

April 5. Intense pain from knee to groin.

10*th.* Same pain; extension eight pounds.

13*th.* Extension ten pounds; lateral traction.

19*th.* Diminished redness of right hip; patient has had very little pain since lateral traction (five pounds) was applied.

25*th.* No pain at all.

May 2. No pain; measured for splint.

27*th.* Doing well; remains comfortable, with weights as above; very marked relief from lateral traction.

In answer to the first problem, we find that a majority of these cases were distinctly relieved by lateral traction. Case IV. seemed a little worse for it. Cases III., VIII., and X. are practically negative as far as benefit is concerned. Case V. probably was benefited.

A good many other cases at the Children's Hospital have been benefited by the application of lateral traction, but I think these cases, all of which have come under my own observation, are enough to establish the point. In general, lateral traction may be of use in relatively acute cases when pain or night cries persist

after traction has been applied. It may serve to make some cases more comfortable, even though they have but little pain.

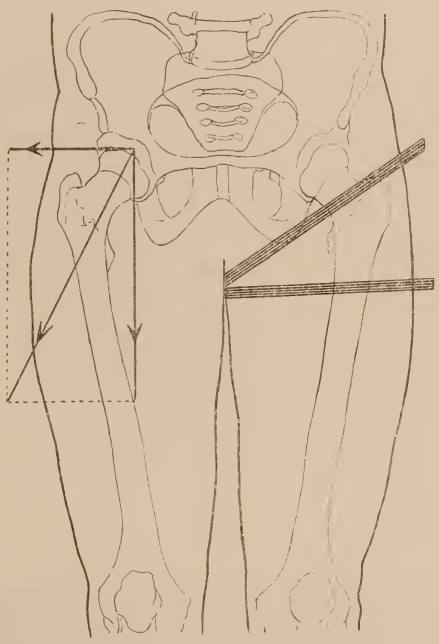
Treatment by lateral traction may be continued as long as the hip is sensitive, if necessary, by some special lateral traction splint.

The answer to the second problem is, No. Case II. was made decidedly worse by leaving off the end weight. Case I. and Case III. showed no advantage in leaving off the end weight, and, indeed, it is hard to see even on theoretical ground, how there could be any advantage, for there would be nothing to counteract the spasm of the long flexor muscles.

The third problem deals with the amount and limit of the traction.

Before discussing the figures in detail let us see what we expect traction to do.

Fig. 4.



The irritation of the diseased joint surfaces causes a reflex spasm of the muscles which drives the head of the femur upward

and backward against the acetabulum. The object of traction is to relieve the pressure of the opposing surfaces and to separate them slightly (distraction).

There is a limit to the amount of traction that can be applied, varying with the size of the limb, the kind of extension, and the sensitiveness of the skin; but a continuous force considerably less than this limit is usually enough to overcome the muscular spasm.

With sufficient traction the muscles gradually "tire out." Though they retain a certain amount of their normal tension and elasticity, they may lengthen appreciably, and will adapt their shape to the position of the limb.

FIG. 5.

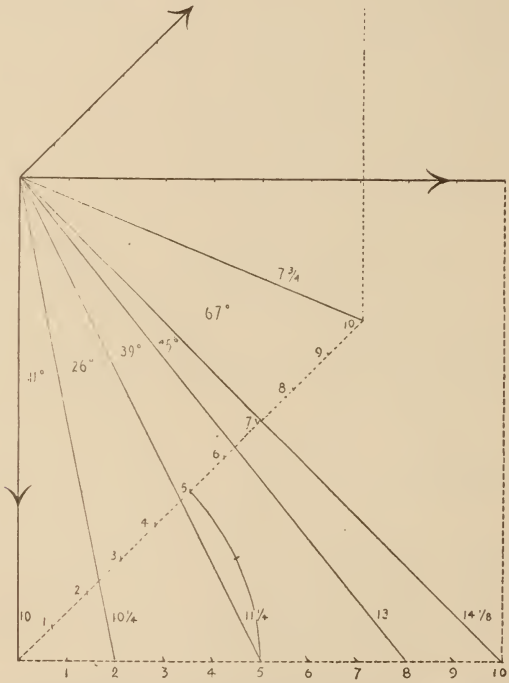


Diagram showing effect on a longitudinal force of ten pounds, of a lateral force of from one to ten pounds applied at 90°.

Traction applied in the axis of the limb pulls directly upon the head of the femur. This, in a child, can easily pass the lower edge of the acetabulum, but in an adult it must first move outward in a

line with the axis of the neck. We cannot apply a single force to act on the thigh in this line, but we can apply two forces whose resultant will so act. By the aid of a well-known principle of physics, called the "composition of forces," we are able to calculate exactly the direction and the intensity of the resultant force. For example, suppose a longitudinal traction of ten pounds and a lateral traction of five pounds applied at right angles. When these forces are represented by lines of proportionate length, the resultant is determined by the diagonal of the parallelogram made by the two lines and their projections. (Fig. 4.) In this case the resultant is eleven and one-quarter pounds, and makes an angle with the longitudinal force of twenty-six degrees. In order to show the possible effect of different weights of lateral traction I have made a diagram showing the result of a lateral force of from one to ten pounds upon a longitudinal force of ten pounds applied at right angles and also at forty-five degrees more than a right angle. (Fig. 5.)

The results are shown in the following table. To find the result when the longitudinal force is different from ten pounds it is only necessary to reduce the ratio between the latitude and longitude to a decimal. The figures are approximate and correct to nearest degree and fraction of a pound:

Ratio.	Applied at 90°. Resultant:		Applied at 135°. Resultant:	
Lat. and Long.	Pounds.	Angle.	Angle.	Pounds.
0.1	$10\frac{1}{2}$	6°	4°	$9\frac{1}{4}$
0.2	$10\frac{1}{2}$	11°	10°	$8\frac{3}{4}$
0.3	$10\frac{1}{2}$	17°	16°	$8\frac{1}{4}$
0.4	$10\frac{3}{4}$	22°	22°	$7\frac{3}{4}$
0.5	$11\frac{1}{4}$	26°	29°	$7\frac{1}{3}$
0.6	$11\frac{3}{4}$	31°	37°	$7\frac{1}{4}$
0.7	$12\frac{1}{4}$	35°	45°	$7\frac{1}{16}$
0.8	13	39°	52°	$7\frac{1}{4}$
0.9	$13\frac{1}{2}$	42°	60°	$7\frac{1}{3}$
1.0	$14\frac{1}{8}$	45°	67°	$7\frac{3}{4}$

The action of the muscles in modifying the traction is too complex to be stated accurately. It probably varies with each case according to age and the muscular development. We are not able to estimate the force exerted by muscular spasm; it is probably considerably more than any traction we can apply. But are now

considering the muscles are tired out by continued traction, as lengthened and moulded into shape by the position of the limb and the traction straps. Still the muscles have some effect on the movement of the femur. There is resistance to the long pull and to the lateral pull, but the difference between the two is sufficiently small, it seems to me, to leave the result of traction, as expressed in the table, substantially correct within a reasonable limit of error.

The point of application of the lateral force is necessarily considerably below the head of the femur. It is probably a little higher when the lateral traction is directed upward.

It has been objected that lateral traction applied close to the groin tends to shorten the adductor muscles and so draw the femur against the acetabulum. Also that the same result might occur by leverage of the femur, the short rotators acting as a fulcrum when a lateral force is applied and the leg free to abduct. To the first objection we may answer that under the influence of continued traction the muscles become longer and shape themselves to the new condition. The second objection is not valid if the leg is fixed by sand-bag or strap to the amount of abduction. Care must be taken, also, to keep the lateral traction band in place.

It would not be practicable, I think, to make the lateral force equal to or exceed the longitudinal force, because the single band keeps pressure on the skin at one place, while with an adhesive plaster extension the tension is widely distributed.

From these somewhat theoretical considerations let us now turn for a moment to the weights accurately used in the cases reported. By writing the lateral over the longitudinal we get their ratios:

Case I.: $\frac{3}{5}$, $\frac{3}{4}$ = 0.6, 0.75.

Case II.: $\frac{2}{3}$, $\frac{2}{4}$, $\frac{2}{6}$, $\frac{}{6}$ = 0.66, 0.5, 0.33, 0.5.

Case IV.: $\frac{2}{3}$ = 0.66.

Case VI.: $\frac{2}{8}$ = 0.25.

Case VII.: $1.\frac{5}{3}$, $1.\frac{5}{5}$, $1.\frac{5}{7}$ = 0.5, 0.3, 0.21.

Case VIII.: $1.\frac{5}{4}$, $\frac{3}{4}$ = 0.37, 0.75.

Case IX.: $\frac{8}{13}$, $\frac{3}{18}$ = 0.6, 0.16.

Case X.: $\frac{5}{10}$ = 0.5.

Case XI.: $\frac{5}{10}$ = 0.5.

These seventeen ratios vary from 0.16 to 0.75, the average being about 0.50. They represent fairly the limits that are practical.

Less than 0.10 or 0.15 would hardly be of any use, while more than 0.75 or 0.80 would not be needed. By using the ratio we are able to compare the child requiring one and one-half and three pounds with the adult requiring ten and fifteen pounds.

There remains the question applying the lateral traction exactly at right angles or inclined upward. It cannot be drawn downward, because the band will slip. From the diagram it is clear that the greatest amount of pull can be obtained by applying the lateral weight at a right angle. But the greatest change in direction can be secured by inclining the band upward 25° for a ratio of 0.5, and more when the ratio is larger.

For the fourth problem I have not made any special experiments. Dr. Bradford has shown conclusively (Trans. Amer. Orthoc. Assoc., 1893) that the hip-joint is in the best possible anatomical position to yield to traction when the thigh is slightly flexed and abducted. If lateral traction is to be applied the thigh should also be slightly everted. With the limb in this position the limits of traction may be stated as follows:

1. Amount that can be made to hold on, *i. e.*, tension on skin.
2. Amount possible to apply; strength of cord or splint; skin of perineum.
3. Muscular resistance.
4. Pain due to stretching capsular ligament.
5. Limit of usefulness. When the surfaces are distracted and held so, there is no need for further pull.

Experience at the Children's Hospital has shown that when a weight of more than ten or twelve pounds is applied, the extension slips down and has to be renewed every three or four days. Also in a patient with sensitive skin, a heavy weight will make it excoriate sooner than a light one.

SUMMARY.

1. Lateral traction properly applied in connection with longitudinal traction gives relief in some acute cases.
2. Lateral traction alone has no advantage.
3. The amount of weight in lateral traction should be in relation to the amount of longitudinal traction. A good proportion is five

pounds lateral to ten longitudinal applied 25° beyond a right angle. The minimum useful proportion is $\frac{1}{10}$; the maximum, $\frac{8}{10}$.

4. The tension on the skin is the most important factor in limiting the amount of traction when the thigh is slightly flexed, abducted, and everted.

NOTE.—In discussing this paper, Dr. A. M. Phelps, President of the American Orthopedic Association, said that about two-thirds of the longitudinal force is expended in moving the weight of the limb, so that one pound lateral traction is as efficient as three pounds longitudinal. Ordinarily, then, $2\frac{5}{10}$ would be a sufficiently large proportion to move the head of the femur in the direction of the axis of the neck.

EXCISION OF THE WRIST-JOINT BY A NEW METHOD.

By HERMAN MYNTER, M.D.,
BUFFALO, N. Y.

While excisions of the wrist-joint have become very rare on account of the excellent results of iodoform injections in this locality, we meet, nevertheless, occasionally old and neglected cases of tuberculous wrist-joint affections, with total destruction of the whole carpus and adjoining bones, extreme looseness, crepitation, and numerous fistulæ, in which conservative treatment is all but useless, and in which the choice lies between amputation with quick recovery, and excision followed by a prolonged and tedious convalescence, with probably in the majority of cases a more or less useless hand as a final result.

The principal cause of this slow and protracted convalescence is the impossibility of making a radical operation by the usual longitudinal incisions and of removing all the tuberculous material, unless the operation be done so early that there is still a good deal of cohesion between the different joints, so that the carpus can be removed in one piece.

As, on account of the excellent results of iodoform injections, early operation may be considered distinctly contra-indicated, we will have resource to excision in old and neglected cases only, in which it is impossible to remove the fatty, degenerated, softened, and carious bones but in piecemeal, leaving a large amonnt of the tuberculous bony tissue and a still larger amount of the tuberculous synovial tissue in the wound. What would be the result, I ask, if a knee-joint, or any other joint, was excised in that way? Protracted suppuration and tuberculous relapses, necessitating repeated operations and probably terminating in amputation, would, as a matter of

fact, follow such a proceeding, and when we in our day get healing of our resection wounds by first intention, the cause, and the only cause, is that our antiseptic methods allow us to make such free dissections that all vestige of tuberculous material in bones and synovial membranes may be totally eradicated.

This, I maintain, is impossible by the usual longitudinal incisions of Ollier and Lister in excision of the wrist. I have tried both several times, and the result has been, to say the least, unsatisfactory.

In *Hospitalstidenden* of January 7, 1891, Professor Studsgaard, of Copenhagen, advocated a complete splitting of the foot from before backward in order to gain free access to the diseased focus in the anterior tarsal and posterior metatarsal bones. Incidentally he recommended a similar splitting of the hand for tuberculous osteitis of the carpus, making a longitudinal incision between the third and fourth metacarpal bones, and thereafter opening up the joints between os magnum and unciform bone, and between semilunar and cuneiform bones. Both superficial and deep palmar arches are, of course, severed, and must be ligated in the wound. I do not know if this suggestion has been acted upon before, but I have lately—in March, 1894—had the opportunity of trying it myself on a woman, thirty-five years of age, and I was astonished at the ease and facility with which every vestige of tuberculous material could be and was removed.

I only made the change of splitting between second and third metacarpal bones, and then entering between trapezoid and os magnum, and between scaphoid and semilunar bones, as by this incision the hand was more evenly divided. While I made the dorsal incision to reach up to the radius, I found it unnecessary on the palmar side to extend the incision farther than the base of the thenar of the thumb. The annular volar ligament was therefore not severed. By careful dissection from the dorsal side, and forcible separation, I found it easy to avoid injuring the dorsal tendons and the large palmar tendinous bursa.

The whole carpus could now be widely opened, and it was extremely easy with scissors to extirpate the two halves of the carpus, and with a fine saw to remove the surfaces of radius, ulna, and the metacarpal bones. The wound was thereafter sutured, but in order

to produce strong and healthy granulations, which secondarily might contract and form fibrous tissue, I packed the large cavity with iodoform gauze let out through the upper part of the wound on the palmar side. The patient got up on the second day, and the wound healed by first intention. The gauze packing was removed once a week for seven weeks, and then omitted, the wound healing promptly. The result is so far—eight weeks after the operation—extremely gratifying. She is able actively to extend and flex the wrist and move the fingers, but there is still some looseness in the wrist-joint, although it is steadily getting firmer. Judging from this case I consider Studsgaard's operation far superior to Ollier's and Lister's longitudinal or the old transverse incisions, by which last methods we necessarily get adhesion of the tendons to the cicatrix, and I take pleasure in calling your attention to this method in old and neglected cases of tuberculous arthritis of the wrist.

DISCUSSION.

Dr. Whitman asked if the same method of operation was employed in excision of the ankle and tarsus.

Dr. Mynter replied in the affirmative, stating that the incision should be made between the large toe and the second toe, thus splitting the whole foot in two until the cuneiform bones was reached. The operator then passed between the cuneiform and cuboid, or, if the disease were far back, between the scaphoid and the cuboid.

ETIOLOGY OF DEFORMITY OF KNEE-JOINT DISEASE.

By A. E. HOADLEY, M.D.,
CHICAGO.

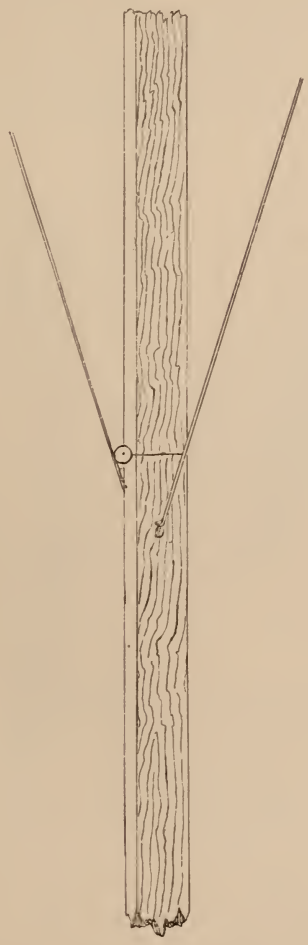
In a paper read before the American Orthopedic Association by A. M. Phelps, upon the above title, and published in the Transactions (Vol. VI.), the following statements were made, which, not being in accordance with anatomical and physiological facts, I take it upon myself to point out their errors.

In the first place, it is stated that the knee-joint is a simple hinge, and illustration given (Fig. 1). Second, that with a straight leg the extensors can dominate the flexors, or hold the leg straight; but as soon as flexion has taken place a few degrees the flexors can dominate and overpower the extensors (Fig. 2), although the latter is much the larger group, and that the flexors increase in power as flexion progresses, and the extensors lose in power as flexion progresses. And, thirdly, that as soon as the knee-joint disease is established, what little preponderance of power, if any, the extensors may have over the flexors is rapidly lost from the rapidity of atrophy of the extensor group; and as soon as disease of the knee-joint is established, according to this theory, the rapid atrophy of the extensors, together with the preponderance of leverage of the flexors over the extensors, the flexors are able to deform the knee-joint in spite of the resisting power of the extensors.

Now, anatomy teaches us that the knee-joint is not a hinge-joint; that it is a compound arthoridal joint, nearer a hinge-joint than any other simple form, but that it is not a hinge-joint is well established, inasmuch as it has no common centre around which the head of the tibia revolves. With each degree of flexion of the knee-joint the centre around which the tibia is revolving is con-

stantly changing. And then, again, the external condyle being longer from before backward than the internal condyle, it is necessary for the external articular surface of the head of the tibia to

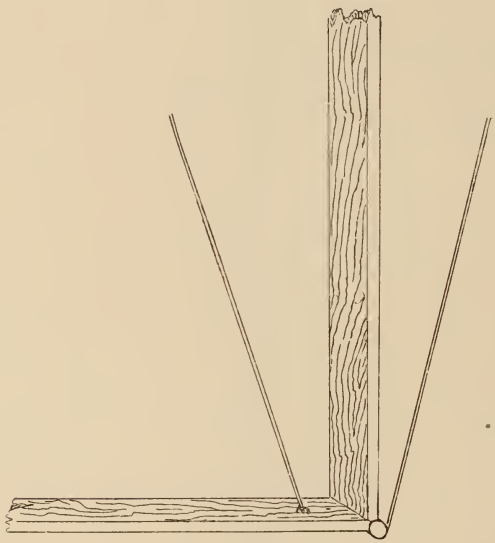
Fig. 1.



travel a greater distance during flexion or extension, and consequently there is a rotation of the tibia upon the femur and upon itself, thus making of it one of the most complicated joints in the body.

The second statement, to the effect that the flexor muscles increase in leverage and power as flexion progresses, and that the extensors are diminished in power, does not hold good either from an anatomical standpoint or in actual effort, as demonstrated by weighing the muscle strength of eighty men. In the first place, the flexors and extensors are equally balanced as to leverage with the fully extended limb (Figs. 1 and 3), but as flexion progresses the flexors are gradually diminished in power, owing to the fact that the tendon is constantly changing its direction of traction

Fig. 2.



to the vertical axis of the tibia from the commencement of flexion until after it passes 135°, when the flexors actually become extensors (Figs. 4 and 5). This is due to the fact that the flexors are inserted into the upper margin of the head of the tibia and into the apex of the highest point of the fibula—the biceps, and the greatest amount of leverage is only about one and one-half inches from the upper end of the head of the tibia to the centre around which the head of the tibia may be revolving, so that the amount of leverage possessed by the flexor muscles at the commencement of their action with a straight limb is about an inch and a half

long, and this distance is gradually diminished until at a point from 130° to 135° there is actually no leverage; beyond that point it is impossible for flexion to be induced by voluntary, unaided,

Fig. 3.

muscular effort. If the limb is voluntarily or by extraneous means flexed beyond 135° the flexors themselves become, as you see by these illustrations, extensors. (Fig. 5.) This anyone can demonstrate to his own satisfaction, if he is not too fleshy, by grasping the ankle with the hands and making forced flexion, bringing

the heel against the upper part of the thigh and then making a voluntary effort to further flex the limb, and he will see to what

Fig. 4.

Fig. 5.

extent the effort of the flexors will extend the limb. Then, if you will look at the other side of these illustrations, at the extensors,

you will see that the leverage of the quadriceps extensor group is about the same as that of the flexor group, although much larger muscles, that is, the posterior bearing of the articulation from the point of attachment of the ligamentum patella is about an inch and a half. This point of leverage remains the same and has no relation to the centre around which the tibia revolves. (Fig. 3.) As flexion progresses you will observe the tibia slides back upon the condyles of the femur, and the ligamentum patella holds the same relation to the tibia that it did at the start, namely, pulling in the line of the shaft of the tibia. (Fig. 4.) Contrast Fig. 4 with Fig. 1. If we will follow it still further and have the head of the tibia resting upon the posteriar articular surface of the femur, or with the leg flexed at an angle of 90° (Fig. 4), we still see the patella tendon in line with the tibia, and the whole force of the quadriceps extensor group can be exerted upon the tibia in the direction of extension with the same degree of power that it could at the commencement, not only with the same degree of power, but, as actual experiment has demonstrated, with an increase of power. We will carry the flexion still further, carrying it to 135°, and we find the ligamentum patella still holds the same position to the shaft of the tibia that it did when it started, the patella being a fulcrum or pulley over which the quadriceps extensor group operates to extend the limb. (Fig. 5.)

Now, it can be readily seen from these illustrations that instead of diminishing the leverage of the extensor group, they are actually increased by the flexion of the limb. This is not so apparent in looking at the illustrations as it is when we come to actual weighing of muscle effort. The reason that the power is increased is in consequence of the extension of the muscles, the greatest power of the muscle being when it is moderately extended. The muscle cannot exert its greatest power in starting from extreme extension, neither can it exert its greatest power when extremely contracted, but moderately extended it gives it its greatest advantage, and the quadriceps group being moderately extended allow the leg to become flexed at from 90° to 120°, which is the greatest amount of power of extension that the quadriceps group can be induced to exert. If we look at this illustration (Fig. 5) we find that at no point in the flexion of the limb is it possible for any tendon to be

inserted farther than one-half inch below the upper or articular surface of the head of the tibia; therefore, at no point, after flexion has passed forty-five degrees, can the flexor muscles operate with a leverage greater than one and one-half inches, and after flexion has passed beyond 90° this leverage of one and one-half inches is constantly diminishing until it is lost and passes by the centre and actually becomes extension.

These are anatomico-physiological facts capable of demonstration, as shown in the dry specimen and in this preparation of the knee-joint, and illustrated upon these drawings.

To demonstrate these facts to be correct in practice I had constructed an apparatus in which there was adjusted a spring-scale capable of weighing 200 pounds. The scale was so adjusted that muscles efforts could be weighed in four positions: 1. The amount of power exerted by the extensors with the leg straight. 2. The amount of power exerted by the extensors with the leg at an angle of 90° of flexion. 3. The amount of power exerted by the flexors with the leg straight. 4. The amount of power exerted by the flexors with the leg flexed at 90°.

The muscle efforts of eighty well-developed medical students at the College of Physicians and Surgeons were accurately taken by means of this apparatus, under the supervision of Drs. R. Fyfe and D. W. Evans. It was found that the extensors with the leg fully straight could exert an average extension power of 96 pounds, and that the extensors could exert a power of 160½ pounds with the leg flexed at an angle of 90°, showing that the extensors had increased in power as flexion had advanced, being capable of exerting 64½ pounds of extension pressure more at flexion of 90° than with the leg straight. The flexor group (the average of the eighty medical students) was found to give a flexing force of about 85½ pounds with the leg straight, and with the leg flexed at an angle of 90° a flexing force of 46½ pounds, showing that flexion decreased in power as flexion progressed, losing about 39 pounds between the straight position and the position of right angles; so that at no point are the flexors equal to the extensors, and that the flexors diminish nearly one-half in being flexed at an angle of 90°, while the extensors increase more than one-third during the same distance. The weakest point of the extensors is stronger than the strongest

point of the flexors, and after passing 90° the flexor group rapidly diminish in force, and at 130° there is practically no power for flexion left.

Clinical experience, as far as I have been able to observe in the cases I have treated, and as far as the literature upon the subject goes, shows that the atrophy in the groups of muscle is equal; that there is no preponderance of atrophy of the extensor group over that of the flexor group. Therefore, in regard to the etiology of the deformity of knee-joint disease, we must exclude muscle effort entirely as far as the preponderance of one group of muscles over the other is concerned. The extensor group at all points and under all circumstances is the most powerful; that flexion is always dominant in deformity of knee-joint disease coupled with subluxation backward, which in all probability is due to the action of the flexor group. The fact of muscle preponderance has nothing to do with the etiology of deformity. The old explanation of shrinking, cringing, and shifting position for the purpose of relieving pressure and pain, is the only explanation of the deformity, and when once the limb is flexed it is impossible by voluntary effort to extend it, owing to the pain induced by the increase of pressure between the head of the tibia and the condyles of the femur. The muscular irritability and spasm that are always induced in all forms of joint-disease can best be explained by the term neuro-muscular phenomenon.

In summary I would state that from an anatomical study of the knee-joint and the arrangement of the muscles, together with their insertions, and from the actual weighing of the muscle's efforts, the propositions cited as the basis of this paper are absolutely and diametrically incorrect.

DISCUSSION.

Dr. W. E. Wirt, of Cleveland, Ohio, showed on the blackboard how one could, by the application of the principles of trigonometry, determine how much force was consumed in friction, and how much in actual flexion or extension.

Dr. Whitman said that in these calculations and observations the gastrocnemius muscle had not been mentioned at all. Although, perhaps, it was not of much importance from a theoretical point of view, it certainly was of importance as resisting the rectification of deformity.

Dr. Phelps said he had hoped that this paper of Dr. Hoadley would give an insight into the reason for these deformities. The knee-joint came nearer being a hinge than anything else. It was a compound hinge-joint; there could be no question about that. He believed most emphatically that the propositions in Dr. Hoadley's paper were incorrect. The author had stated that with the limb in a straight position, the student was capable of exerting a force of seventy-five pounds. This differed materially from his own experiments, in which the force had been found to be only thirty-five pounds. These figures were practically the same as those of Horton, of Dublin, for the latter had found these muscles to be capable of exerting forty-four pounds in a similar individual. The same criticism applied to the figures obtained in the other experiment. In his former paper he had attempted to prove, if possible, why the limb assumed certain positions in disease. Dr. Hoadley had not done that, but had instead offered criticisms on his propositions. If Dr. Hoadley could offer any reasons for the limb assuming the flexed position in disease of the condyles or of the head of the tibia, he would be glad to consider them.

To answer the question, "Why does the limb always assume the straight position when there is disease of the patella, and not of the femur and tibia?" and "Why does the limb always rotate in proportion to flexion?" he had performed a series of experiments and drawn certain conclusions which had been published in the Transactions of this Association.

In the paper just read the author had stated that as the limb flexed the extensors did not increase in power; that as the limb flexed the quadriceps did not decrease in power; that when the limb was straight the quadriceps was weaker than when the limb was flexed; that the quadriceps muscle was weaker when the limb was straight than when flexed; and that the flexor muscles were weaker when flexed than when straight. He could not accept these

statements for the following reasons: that the joint was bound firmly together by the crucial, the lateral, and the capsular ligaments, and it should not be forgotten that when the leg was flexed the quadriceps muscle acted over a pulley, and did not do so when in a straight position. When in the straight position there was no friction; but when flexed there was a tremendous pressure, which might even produce fracture of the patella; in other words, exert a force of over eleven hundred pounds. This force indicated to him that the lost force was the loss of power of that muscle to operate upon this joint when flexed. The force applied against the tibia by contraction of that muscle when the limb was in the flexed position, and which was capable of fracturing the condyles of the femur, was marked when the limb was flexed; therefore, that muscle must be necessarily weakened so far as the effect on the lower segment of the bone was concerned.

If he understood physics and mathematics properly he understood that when a force operated over a pulley it was necessarily diminished by friction; and that when this limb was flexed that force must necessarily be distributed to the end of the bone, and necessarily weaken that muscle. Now, in his own experiments, which differed entirely from those given in the paper under discussion, he had found that when the leg was perfectly straight the extensors were at the greatest possible advantage. The amount of resistance, as estimated by a spring balance, was two hundred and forty pounds, but when the limb was flexed the resistance was one hundred and thirty-six pounds. On applying the same method to the extensors, he found that when the limb was in the straight position the force of flexion was only thirty-five pounds, and when the limb was flexed a weight of ninety pounds could be suspended from the heel. These experiments harmonized almost exactly with those of Horton, of Dublin. These were his reasons for believing that flexion had a decided influence on the strength of these muscles.

It must not be forgotten that, owing to the insertion of the muscles, they were acting on a lever, *i. e.*, from the attachment of the muscle to the centre of the bone, and hence it was not one inch, as stated in the paper, but three inches.

Now as to rotation. The fibula standing well out from the head of the tibia, and a little higher, as the limb was flexed, the lateral

ligaments were relaxed, and the great biceps tendon being attached to one side of the end of the fibula, representing a lever having a length equal to the distance from the centre of the condyle to the attachment of the biceps to the head of the fibula, this force necessarily rotated the limb outward, as shown in the specimen. (Illustrating by a specimen.) This, we believed, was the cause of the rotation. The author had stated that when completely flexed the flexors became extensors; but he seemed to forget that the muscles were still operating on the lever.

The speaker said that his conclusions were that the typical deformity was produced by voluntary effort to relieve pain by relieving intra-articular pressure. According to his experiments, the quadriceps extensor lost its power, the flexors increased in power, the biceps tendon caused rotation, and flexion and rotation increased together.

Dr. Ridlon remarked that one point had been overlooked by all who had spoken, viz.: that the muscle when approaching anywhere near its full point of contraction ceased to be strong. This was demonstrated very forcibly in flexion of the hand. The same was true of the flexors and extensors of the leg. Just what this diminution was he could not say, but it was a point which had some bearing in the consideration of this subject.

Dr. Hoadley said that the latter part of the paper, which had not been read, took up the question of the advantage of power in proportion to the contraction of the muscle—the point just alluded to by Dr. Ridlon. The extensors possessed their greatest power at an angle of 90°, from the fact that they were extended to the best possible position. In regard to the etiology of the deformity in knee-joint disease, he had referred to it as an effort of relaxation, and not one of domination of the stronger over the weaker muscles. The passing of the tendon across the condyle was like passing over a pulley having a radius of only about an inch, and under these circumstances the friction was so very slight as to be hardly worth considering. Dr. Phelps' experiment had been confined to one man, whereas his experiments and muscle-weighing were upon eighty well-developed medical students who did

their best. In no case did those efforts correspond to what Dr. Phelps had said; the greatest amount ever pulled with the flexors at right angles was seventy-five pounds. The scales used only weighed up to two hundred pounds, but it was estimated that many of the students pulled, or rather pushed, with their extensors as high as two hundred and fifty pounds. In no instance was a greater power developed in their flexors than at the weakest point in their extensors. The flexors could not flex at an angle of 90° more than an average of forty pounds under the most favorable circumstances. The gastrocnemius certainly was a very powerful flexor-muscle, and, as it was inserted into the articular surface of the condyles of the femur, it had exactly the same relation as regards flexion as the flexors had; but after a certain point of flexion the gastrocnemius was powerless.

EXCISION OF THE KNEE FOR THE RELIEF OF CRIPPLING FROM INFANTILE PARALYSIS.

By AP MORGAN VANCE, M.D.,
LOUISVILLE.

In 1885 I reported a case upon which I had operated a year before for the production of synostosis at the knee to relieve crippling from infantile paralysis. Since then I have done this operation six times, making seven excisions in all upon five patients. It is to report some conclusions in regard to this class of work that I offer this short paper.

All of the patients were hopelessly crippled and deformed, and ranged between seven and seventeen years of age. The two oldest of these died, at fifteen and seventeen; one, aged nine, is now convalescing, two, aged seven and nine, are wonderfully relieved.

Those that died were both affected alike and very peculiarly. Both died at the end of ten days, apparently from some inflammatory complication of the heart (endocarditis?). It is these fatal cases that I wish particularly to call attention.

In the first, aged seventeen, for five days after a double excision the condition was good, no evidence of any complications; then the heart's action became very rapid and an extensive eruption occurred on different parts of the body, resembling urticaria, the whelks being very large and universally crescentic in shape, being raised fully one-half inch above the surface. There was little or no fever until just before death. Examination of the wound showed no inflammatory action, and the parts around the wound were free from the eruption. There was no pus present, but a large quantity of an oily substance or fat exuded when the wounds were reopened. No further examination was allowed.

The second case, aged fifteen, died with exactly similar symp-

toms and at the same period after operation. The strictest aseptic precautions were observed in both these cases.

Conclusions.—1. The danger in these operations is in proportion to the age of the patient, and consequently the degree of fatty degeneration present.

2. That both these deaths were due to fatty emboli or the absorption of some non-septic material into the blood which caused the fatal heart complications.

3. That though the younger cases may be subjected to this procedure with every hope of success, both as to function of the stiffened limb and as to life, the rule does not hold good in the older cases, say after ten or twelve years of age.

OBSERVATIONS ON BENDING OF THE NECK OF THE FEMUR IN ADOLESCENCE,

With Particular Reference to the Diagnosis and Significance of the Affection.

By ROYAL WHITMAN, M.D.,
NEW YORK.

It is proposed in this paper to call attention to a deformity at the hip-joint that develops in adolescence under the same conditions as the other more familiar deformities of the lower extremity, most often in those who, at a period of rapid growth, of weakness and instability of the bones, are subjected to overwork or strain by occupations that require long standing or the carrying of heavy weights.

In this sense overwork is a relative term, since only a small number of individuals in a particular occupation break down, while similar deformities may appear in those who have not been subjected to these exciting causes. In many instances, therefore, one must recognize predisposing causes to explain satisfactorily a given deformity—such as the assumption of improper attitudes; or an inherited predisposition to deformity; or actual weakness of structure, either general or local; or slight deformities acquired in childhood, the effect of weakness or rhachitis, or of injury or disease, which increase under favorable conditions in later life.

The effect of this disproportion between the work to be performed and the strength of the supporting structure is most often seen in the member subjected to greatest strain in the production of flat-foot, which, indeed, may develop at any age and under a great variety of conditions; less frequently in distortion at the knee, and far less often in bending of the neck of the femur, which may or may not be associated with the preceding deformities.

The symptoms of this type of progressive deformity of the lower extremity in adolescence vary according to the function of the joint affected, the rate of progress, the extent and duration of the deformity, the secondary changes induced, and their effect upon the gait and posture of the individual; but, in general, they are weakness, awkwardness, local pain on exertion, and stiffness in the affected joint in changing from a period of rest to activity.

It is the pain of flat-foot, not the deformity, which impresses the patient. At the knee-joint it is the deformity, not the pain or disability, for which advice is asked, and in the analogous deformity at the hip it is often the disability, rather than pain or deformity, that attracts attention.

It is only in very recent years that an affection so common as flat-foot has been generally recognized or treated by physicians, and it is therefore not strange that a comparatively rare condition, in a joint so deeply seated and concealed by overlying muscles, has attracted so little notice.

In 1889 E. Müller[1] reported four cases of bending of the neck of the femur as a new type of disease, of which the symptoms were presented as follows:

In adolescence, without apparent cause or following slight injury, the patient begins to limp and to complain of fatigue and pain about the affected joint on exertion. Shortening of the limb is soon apparent, and is caused by elevation of the trochanter above Nélaton's line. The limb is usually slightly rotated outward, extended, or slightly flexed. The motion of the joint is somewhat limited, particularly in abduction; there is no local swelling or tenderness on pressure.

The ages of the patients reported were sixteen, seventeen, eighteen, and nineteen years, and in all the deformity was on one side only.

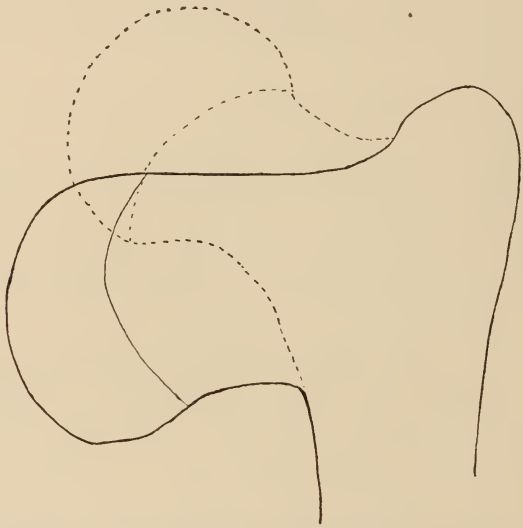
A specimen of the deformity was in one case obtained by resection. The joint surfaces were found to be perfectly normal; the neck of the bone was depressed to a right angle with the shaft (Fig. 1). Section showed no evidence of disease or change other

[1] Ueber die Verbiegung des Schenkelhalses im Wachsthumsalter, Ein neues Krankheitsbild. Beiträge zur klin. Chir., 1889, Bd. iv, S. 137–148.

than that of the internal structure, according to the altered condition of weight and function.

Shortly after the publication of Muller's paper, Rotter[1] presented to the Medical Society of Munich a case of bending of both femoral necks in a boy of fifteen. The symptoms were fatigue and pain on exertion, an awkward rolling gait caused by adduction of the limbs, prominent trochanters elevated above Nélaton's line, and moderate restriction of motion. No evidence of local disease was present.

Fig. 1.



Outline of the depressed neck of the femur in Müller's specimen, contrasted with the normal position shown by the dotted line.

A specimen of very great deformity of the neck of the femur was obtained by Hoffa[2] by resection of the joint. The patient, a girl of fourteen, had begun to limp at the age of three years without known cause; shortening of the leg had steadily increased, unaccompanied by any symptoms other than limp and fatigue on exertion. The appearances were somewhat like those of congenital dislocation of the hip—great prominence and elevation of the tro-

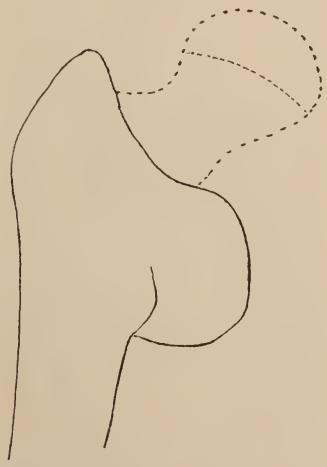
[1] Ein Fall von doppelseitiger rhachitischer Verbiegung des Schenkelhalses. Münchener klinische Wochenschrift, Aug. 12, 1890.

[2] Zur Casuistik der Verbiegungen des Schenkelhalses von Julius Schultz. Zeitschrift fur orthop. Chir., Bd. i, S. 55.

chanter to seven centimetres above Nélaton's line; no marked restriction of motion in any direction.

The joint was normal, but there was such depression of the neck of the femur downward and backward that the head of the bone rested on the trochanter minor at an angle of 60° with the shaft as contrasted with the normal of 128° (Fig. 2). Section showed change in structure, but no evidence of previous disease.

Fig. 2.



Outline of the deformity in Hoffa's specimen. The dotted line shows the normal position.

These cases represent the meager literature of the subject, which has apparently attracted no attention in this country up to the present time.

During the past two years four examples of this affection have come under my observation.

I present the histories of the patients, somewhat in detail, with photographs showing the appearances and effect of the deformity, in the hope that one of the obscure affections of the hip-joint may be recognized and more effectively treated than under such diagnoses as periostitis, tumor, dislocation, rheumatism, hip disease, or paralysis, as in some of the cases to be reported.

Case I.—A well-nourished boy, fifteen years of age, came to the Hospital for Ruptured and Crippled on June 7, 1892. There was

a marked limp on the right side and evident shortening of the leg, for which a high shoe was worn.

One year before, without known cause and without symptoms, a

Fig. 3.

Photograph of Case I., April, 1894. Shows the apparent shortening of the right leg, the prominence of the trochanter, the adduction and compensatory tilting of the pelvis.

gradually increasing limp was noticed, and in six months it was necessary to apply a cork sole to the shoe to compensate for the shortening of the leg.

On examination, the appearances were those of congenital dislocation of the hip—that is, a very prominent trochanter elevated upward and backward, above Nélaton's line.

The actual shortening, measured from the anterior superior spine to the internal malleolus, was three-quarters of an inch. The apparent shortening, measured from the umbilicus, caused by the adduction of the limb, was three inches and a half. The position of the foot was normal. There was no limitation of flexion, extension, or rotation of the limb; the movements were free, smooth, and painless. Abduction was absolutely restricted. That the head of the bone was in the acetabulum was shown by its normal motion and because it could not be moved up or down from its position by pressure or traction.

During the two years intervening between the first examination and the present report, the boy has been examined from time to time at his home. The appearances noted at the first examination have become gradually more marked. The actual shortening of the leg had increased an inch in April, 1893, and to an inch and a half in April, 1894; the trochanter has become more and more prominent, until the deformity is as seen in the photograph presented (Fig. 3), which shows the adduction of the leg, the compensatory upward tilting of the pelvis, and the lateral curvature of the spine.

The patient has worked steadily at his occupation of driver of a peddler's cart; he insists that he has never suffered the slightest pain or discomfort, that his ability to walk and run is equal to that of other boys. His relatives and friends have been carefully questioned, but no variation from the history has been obtained. He was in perfect condition until the age of fourteen years. The limp and shortening began without apparent cause, and have increased without symptoms. All treatment has been refused. He denies overwork or injury at any time, and there is no evidence of former or present rhachitis.

Case II.—The patient, a well-nourished boy of sixteen years, came to the hospital in July, 1893. Except for a somewhat exaggerated eversion of the feet and evident flat-feet, there was nothing peculiar in his appearance.

In infancy he was said to have had weak ankles, and the flat-feet were of indefinite duration, but had never caused pain or discomfort.

For about two years he had been working as a grocer's boy, standing and carrying heavy weights. The previous spring he had been troubled with a peculiar soreness and stiffness about the right hip,

FIG. 4.

Photograph of Case II., June, 1893.

thought to be "growing" pain. These symptoms were entirely relieved by a journey to Canada on a canal boat. On his return his

usual work was resumed, and soon after the discomfort became again apparent, and had slowly increased during the winter; recently similar symptoms had appeared on the opposite side.

The symptoms complained of at this time were a feeling of fatigue and of pain referred to the right trochanter and to the front of the thigh; a peculiar stiffness about the hip after sitting or remaining long in one position. The symptoms were increased by extra work, diminished by rest; there was at no time pain when at rest.

On examination, the eversion and flatness of the feet were very apparent, there was slight knock-knee, slight hyperextension at the knees. The trochanters appeared slightly elevated above Nélaton's line (Fig. 4) and somewhat forward of their ordinary position. The gait was somewhat rolling in character; the motion at the hip-joints was perfectly free in flexion and extension, abduction limited to about a third of normal, rotation inward limited with the feet in the perpendicular line. The restriction was somewhat greater on the right side than on the left, and there was slight atrophy of the muscles of the thigh. The diagnosis of bending of the femoral necks was made; rest, gymnastic exercises, and tonics were advised.

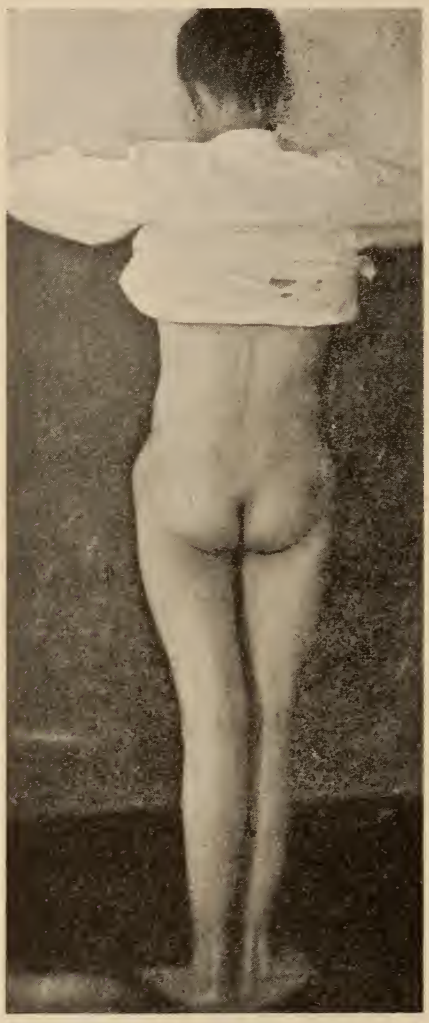
No particular notice appears to have been taken of the diagnosis or advice, for three months later he again appeared at the hospital, at this time able to walk only with much effort, the body swaying from side to side in a very marked and peculiar manner. A number of physicians had been consulted in the meantime, diagnoses varying from hip disease to paralysis having been obtained.

On standing, the prominent trochanters were seen to be markedly elevated above Nélaton's line (Fig. 5), and nearer the median line of the body—that is, although the patient stood with the feet greatly everted, the trochanters were in the position that they should have assumed with the feet inverted. Behind each trochanter there was a deep sulcus; the normal lumbar lordosis was absent; abduction of the legs now limited at the line of the body; flexion of the legs only possible when they were crossed (Fig. 6)—that is, flexion increased the adduction.

Extension of the limbs free; flexion somewhat limited on the right side; no pain or spasm or interference with motion within these limits. Crutches were now ordered.

The patient was again seen at his home four months later, and a final examination was made on May 1, 1894. The adduction had

Fig. 5.



Photograph of Case II., Sept., 1893. Shows, when contrasted with Fig. 4, the relative prominence and elevation of the trochanters, also the absence of the normal lumbar lordosis.

increased so that the patient swung himself along on crutches, the left leg crossed over the opposite. It was only with the greatest

effort that the legs could be passed by one another, so that he usually hitched along with one leg behind the other—the so-called scissors walk.[1] One very noticeable change has taken place: the progress upward of the trochanter on the left side is no longer forward but upward and backward; the pelvis is thus slightly twisted, and, as the weight falls somewhat behind its normal axis, the lumbar lordosis, absent at the first examination, is now well marked. There is a compensatory upward tilting of the pelvis on the left side.

Fig. 6.

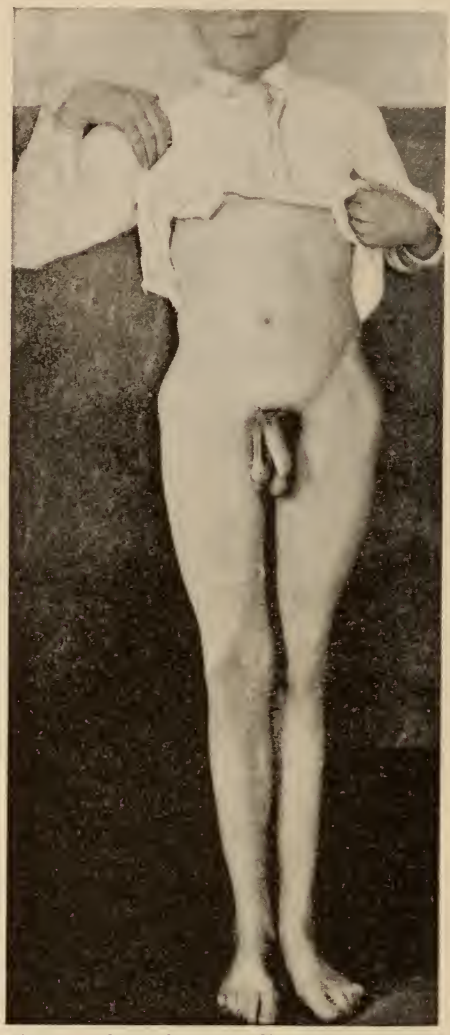
Photograph of Case II., September, 1893. Shows the involuntary crossing of the legs in flexing the thighs on the body.

When lying on the back the eversion of the right leg is so great that the outer border of the foot rests on the table. Inward rotation is possible to 45° only. On flexing the right thigh, the leg crosses that of the opposite side, and with the thigh at a right angle with the body the outward rotation is so great that the heel is in the line of the opposite anterior superior spine. The outward rotation is less on the opposite side, but the adduction is about the same—that is, about 15°. With the limbs parallel and extended,

[1] Petit. Les Jambes en ciseaux. Cong. français des chir., 1892, p. 733.

separation of the knees to three inches and a half only is possible. Flexion at once crosses them, which explains the peculiar walk.

FIG. 7.



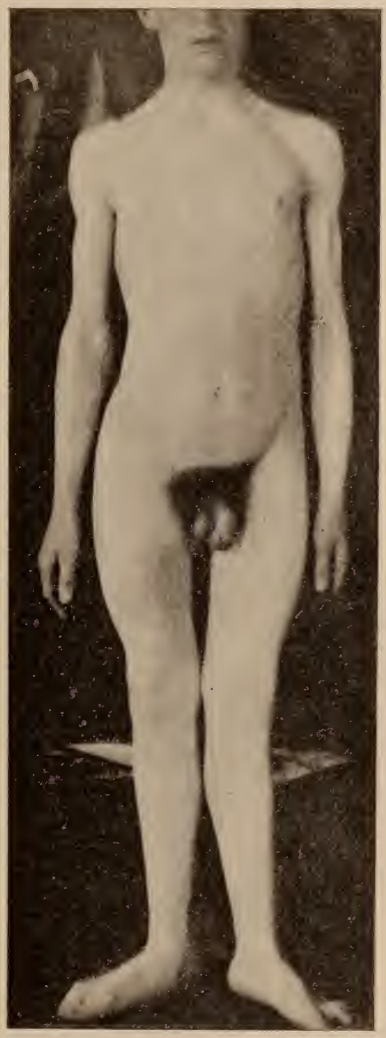
Photograph of Case II., September, 1893. Shows the prominent trochanters.

The trochanters are at least an inch and a half above Nélaton's line.

As the patient stands, the broadening of the pelvis and shorten-

ing of the legs relative to the body is evident (Figs. 7 and 8). He is in perfect health and has no pain; although he has grown very

Fig. 8.

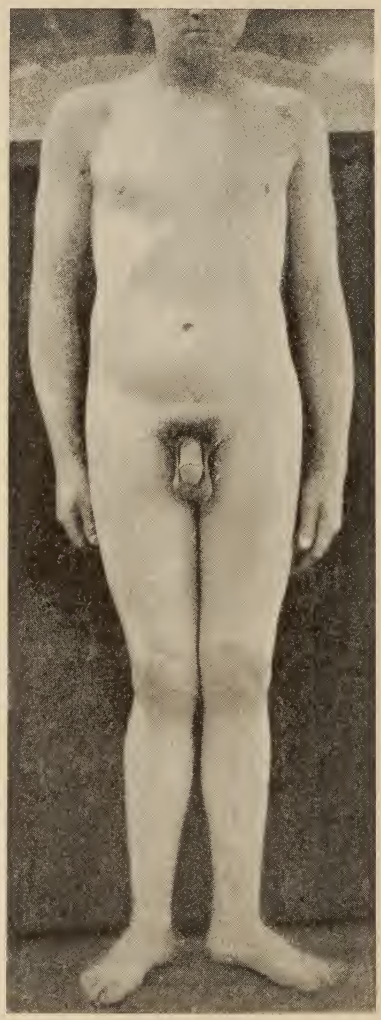


Photograph of Case II., May, 1894. Shows the apparent shortening of the legs relative to the length of the body as constrasted with Fig. 7.

rapidly during the year, the legs measured from the anterior superior spines to the internal malleoli are apparently of the same length

as at the first examination, the increase in growth being compensated by the upward displacement.

Fig. 9.



Photograph of Case III., March, 1894. Shows the slight prominence in the left trochanteric region, the slight tilting of the pelvis, and the knock-knee on the opposite side.

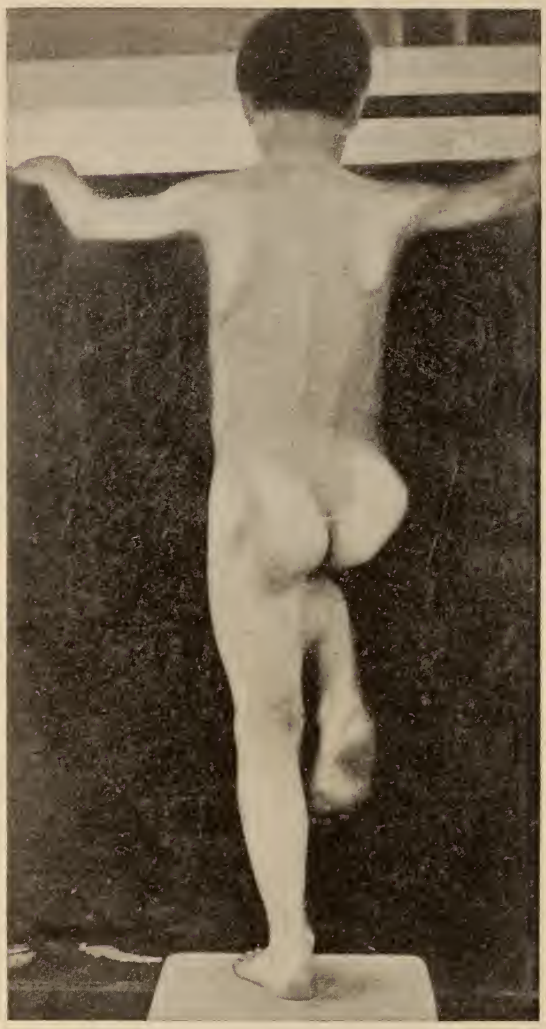
It is believed that the bending of the necks has nearly reached the limit, and it is proposed during the summer to divide the femora

below the trochanters so that sufficient abduction may be attained to make walking possible.

CASE III.—An overgrown German boy, seventeen years of age, applied at the Vanderbilt Clinic on March 1, 1894. He had for a year been working as a baker; the hours were long, and he was obliged to stand constantly. Within the year he had noticed a bending of the right knee and a peculiar stiffness and pain about the left hip and thigh, most marked on changing from a position of rest to activity, as on rising in the morning or after sitting. Examination showed well-marked knock-knee on the right side (Fig. 9), and at the opposite hip-joint restriction of abduction and slight restriction of inward rotation of the leg; slight elevation of the trochanter and approximation toward the median line. The limb was three-quarters of an inch longer than its fellow, as measured from the apices of the trochanters to the soles of the feet, so that no actual shortening was apparent. The treatment consisted in absolute cessation of work, regular gymnastic exercises, massage and stretching of the affected hip and knee. All the pain immediately ceased.

CASE IV.—A healthy, well-nourished Italian boy, aged eleven years, came to the hospital on March 20, 1894, saying that he had been sent by his Sunday-school teacher because he limped. This limp was of possibly one year's duration; there was also at times a feeling of stiffness and discomfort about the hip and front of the thigh after long standing and running at his occupation, that of a newsboy; no pain when at rest. Examination showed slight limp, slight downward compensatory tilting of the pelvis, elevation of the trochanter to an inch above Nélaton's line, and prominence most marked on flexing the limb. (Fig. 10.) One inch shortening; no adduction; no pain on motion or spasm; slight limitation of inward rotation and of abduction. The symptoms and appearances simulated exactly those of fracture of the neck of the femur with upward displacement. As the boy and his mother, whom I afterward saw, thought the symptoms—that is, the limp and discomfort on exertion—were becoming more marked, it was decided to apply a traction hip-splint to relieve temporarily the weakened bone from strain and pressure. This, combined with massage and exercise, relieved the symptoms at once.

FIG. 10.



Photograph of Case IV., March, 1894. Shows the prominent trochanter on the right side, and especially the effect of flexion of the thigh in increasing the deformity.

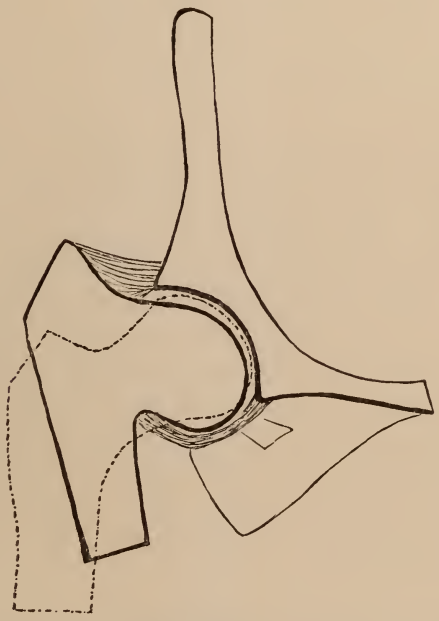
As photographs are presented of all the cases a more detailed description is perhaps unnecessary, nor have the various measurements been given, as it is thought that such details are of more

importance in arriving at the diagnosis than of interest to the readers of the communication.

There is certainly a marked difference in the cases: Cases II. and III. show evidence of the weakness of adolescence in deformity of other joints and present also an exciting cause in the occupation.

In the first case no other joint is affected, nor is there evidence of general weakness or exciting cause; although the deformity is greater than in the three other cases, patient denies pain or discomfort.

Fig. 11.



Cross-section of the pelvis and the deformed femur. A scheme to show the effect of the deformity in limiting abduction of the limb. Dotted outline shows the normal relation.

From the clinical symptoms it would appear that the progress of the bending of the neck of the femur is comparatively rapid until the resistance of the compressed bone is sufficient to oppose further increase of the deformity, or until the head of the bone rests upon the trochanter minor, as in Hoffa's specimen.

Apparently the head of the bone is usually depressed downward and backward in the line of the least resistance; the femur is thus rotated outward, which explains the eversion of the foot; the

trochanter elevated and pushed nearer to the median line of the body. Its prominence is explained by the elevation and by the change in the angle of the neck.

The limitation of abduction of the limb is explained by the pressure of the neck upon the upper border of the acetabulum, of the trochanter on its upper and posterior rim, and by the pressure of the lower border of the depressed head upon the lower portion of the capsule (Fig. 11). In other words, with the legs in apposition, the deformed neck is in the relation to the acetabulum that is normal in extreme abduction of the limbs. Flexion of the limb increases the deformity, as may be explained by the shape and position of the acetabulum; its upper and posterior margin being more prominent, it interferes with the prominent trochanter, so that adduction is increased and the tissues are markedly distended by the projecting bone; thus the assumption of the sitting posture, or rather the change from the erect to the sitting posture, is often painful. This symptom was complained of in the cases of fracture of the neck of the femur in young children which I have reported,[1] in whom the deformity and clinical appearances were very similar to a slight degree of this deformity. If the deformity is of only one side, the symptoms are simply stiffness and limp from the shortening, increased by the adduction of the limb, which causes the compensatory upward tilting of the pelvis. If on both sides, the adduction of the limbs causes the peculiar rolling gait because of the interference of the knees. The deformity of one side may cause merely an awkwardness and limp, but on both sides it may disable the patient.

The character of the pain is similar to that noticed in developing knock-knee and bow-legs of adolescence. The awkwardness and weakness are sufficiently explained by the changed relations of the joint surfaces and of the muscles and ligaments attached to the femur. If the leg is greatly adducted as the result of the depression of the neck of the femur, the conditions are favorable to a gradual upward enlargement of the acetabulum, and it is possible that the final result in as extreme a case as No. 1 may be a partial dislocation from the acetabulum.

[1] Fracture of the Neck of the Femur in Childhood. New York Medical Record, February 25, 1893.

Although Müller was the first to call attention to the clinical significance of this affection, the deformity itself has been described by several others. Röser, in 1843,[1] described a specimen obtained from a subject who died at the age of twenty-four years. During life the limb had been so adducted and flexed as the result of inflammatory disease in the neighborhood of the joint that it had never been used, and was supposed to be a deformity caused by spontaneous dislocation from hip disease. Section showed the joint-surfaces normal and the head of the bone in the acetabulum, the neck being greatly distorted downward and forward.

Zeis, in 1851,[2] described a museum specimen of distortion of the neck of the femur downward and forward, and in this case also section showed no disease.

A very perfect illustration of downward distortion of the neck of the femur to forty-five degrees may be seen in the *Transactions of the Philadelphia Pathological Society* for 1857,[3] obtained from a subject in a dissecting-room. Before removal the deformity was supposed to be the result of fracture. Section showed no evidence of previous injury or disease. The opposite femur was deformed in a similar manner though to a less degree.

Another familiar example of change in the angle and position of the neck of the femur is that of congenital dislocation.

In each of the five instances in which I have had an opportunity to examine the neck of the bone during the operation for its replacement after the method of Hoffa it was depressed to a right angle with the shaft, and in one case markedly displaced forward.

Specimens show depression of the neck as the result of fracture and of local disease, as in osteomyelitis,[4] osteitis, or necrosis, and one case of very great deformity of both femoral necks, somewhat resembling in clinical history Case II., was described and illustrated by Monks,[5] of Boston, in 1886. Although the patient, a boy of eighteen years, suffered from knock-knee and flat-feet in addition

[1] Schmidt's Jahrbücher, 5. Supplementband. Leipsic, 1843, p. 257.

[2] Beiträge zur pathologischen Anatomie und zur Pathologie des Hüftgelenks, No. 1.

[3] Richardson: Deformity of the Neck of the Thigh Bone simulating Fracture with Ossific Union.

[4] Oberst: Ueber Knochenverbiegungen bei akuter Osteomyelitis. Münch. med. Woch., 1890, v. 13.

[5] G. H. Monks: A Case of Unusual Deformity of both Hip-joints. Boston Med. and Surg. Journ., November 18, 1886.

to deformity at the hip-joint, it did not occur to the author, nor to the gentlemen who discussed the case, to include the deformities under one general cause. Dr. Monks was obliged to make the evidently unsatisfactory diagnosis of arthritis deformans to explain the peculiar deformity at the hip. A case somewhat similar in history and appearance to that of depression of the neck of the femur has been reported and illustrated by C. B. Keetley,[1] of London, to whom I am indebted for the original manuscript and photographs of the case. The patient, a girl of twenty years, was admitted to the West End Hospital, in March, 1888, for a limp and marked prominence about the right trochanter. The duration of the deformity was about eight years; she had been treated at various hospitals from time to time under diagnoses of dislocation, periostitis, tumor, and the like. Keetley regarded the case as unique, and called Sir James Paget in consultation, who did not make a diagnosis but advised observation.

Later, Keetley made a diagnosis of local rhachitic disease with bending of the femur in the trochanteric region, because of the slow progress of the disease and the development of a rotary curvature of the spine. As the disability was caused principally by adduction of the limb, Keetley removed a cuneiform section of the bone below the trochanter, and by division of the adductors brought the limb into good position with subsequent great improvement in the posture and gait. The subsequent history is not given. The wedge of bone removed at the operation showed evidence of local rhachitis.

Bending of the neck of the femur may be one of the deformities of osteomalacia, osteitis deformans, and finally, as the result of the very much more common disease, rhachitis.

Lauenstein[2] obtained specimens of downward bending of both femoral necks from a child of six years, who died shortly after the rectification by osteotomy of other rhachitic deformities of the lower extremity. This peculiarity had not been suspected during life. He afterward examined several adult skeletons deformed by rickets, and in one found very great distortion of the femoral necks, the

[1] Keetley: A Case of Rhachitis Adolescentium, etc. Illus. Med. News, London, vol. i, No. 7.

[2] C. Lauenstein: Bemerkungen zu dem Neigungswinkel des Schenkelhalses. Archiv. für klin. Chir., Bd. xl, S. 244.

trochanters being in such close proximity to the rim of the acetabulum that slight motion only could have been possible during life.

Nélaton[1] called attention to the occasional elevation of the trochanters in rhachitic children. I have examined a large number of rhachitic children with reference to this point.

The elevation of the trochanters, when present, is usually either apparent, due to the abduction of the limbs, as in bowlegs, or in other instances seems to be caused rather by an outward bending of the upper part of the shaft than by change in the angle of the neck. In one case, a child of two years, suffering from a mild degree of rhachitis, elevation from bending of the necks appeared to be present, and there was in addition the characteristic limitation of abduction of the thighs, a symptom absent in the other children examined. The legs were nearly straight; the principal symptom, according to the mother, was the difficulty experienced by the child in getting on its feet from the sitting posture.

It is evident, however, that this deformity in early childhood is a rare one compared with the other deformities of rhachitis, probably because the neck of the femur is so short and comparatively large that bending to the extent of producing noticeable and characteristic symptoms is hardly possible.

The question of etiology of the deformity is naturally of importance in its influence on the treatment to be pursued. Müller thought that a local form of late rickets would best explain the weakness of the bone, and this view is supported by Lauenstein.

The term "late rickets" is a misleading one, because it is applied by Clutton,[2] Drewitt,[3] and others to a general disease identical with infantile rickets that may appear in later life, as shown by cases and specimens obtained.

Local rhachitis in the sense used by Müller and others has none of the characteristics of ordinary rhachitis, either in symptoms or in the appearance of the specimens.

Mikulicz, it is true, supported the theory of local rhachitis as the cause of similar deformities at the knee-joint by the broadening

[1] Art. Rachitisme. Nouv. dict. de méd. et de chir., vol. xxx, p. 382.
[2] Clutton: Late Rickets. St. Thomas' Hospital Reports, 1884, p. 105.
[3] Drewitt: A Case of Late Rickets. Trans. Lond. Path. Society, 1881, vol. xxxii, p. 387.

of the epiphyseal cartilage, a condition which Trippier asserts is normal at a period of rapid growth.

As there is at present no direct evidence of local rhachitis, it may be well to call attention to other possible predisposing causes for this deformity; for example, relative slenderness and weakness of the bones, to which attention has been called by Mikulicz,[1] Arndt,[2] and Humphrey;[3] to the variation in the angle of the neck of the femur between 110° and 140° in the specimens examined by Humphrey and Mikulicz;[4] also in its direction. Usually it projects forward from the shaft at an angle of 12°, but in certain specimens this was increased to 20°, and in one it projected backward at an angle of 25° with the shaft.

Some of these peculiarities I have noticed in the dissecting-room of the College of Physicians and Surgeons, especially the variation in the size and apparent strength of the neck in bodies of corresponding size.

Humphrey[5] asserts that there is not, as is usually supposed, a gradual sinking of the neck from childhood to old age, but that the descent is terminated in adolescence. This statement is supported by the observations of Lane.[6] If it is true that a certain amount of depression of the femoral neck is normal during adolescence, it seems reasonable that this may become exaggerated to deformity in individuals presenting, possibly, peculiarities in the shape, size, or position of the bone, or in those subjected to some of the other predisposing causes which have been mentioned. It is possible also that injury, as suggested by Müller, or sudden over-exertion, as in a case reported by Mosetig,[7] may in certain instances serve as the exciting cause of the deformity. Although rhachitis is responsible for most of the extreme deformities of childhood, yet

[1] Mikulicz: Die seitlichen Verkrümmungen am Knie, etc. Archiv. für klin. Chir., Bd. xxiii, S. 561.

[2] Arndt: Pes Valgus, Pes Varus, und das biologische Grundgesetz. Wiener med. Presse, April 6, 1890.

[3] Humphrey: The Angle of the Neck with the Shaft of the Femur at Different Periods of Life and under Different Circumstances. Journal of Anat. and Phys., vol. xxiii, 1889, p. 236.

[4] Mikulicz: Ueber individuelle Formdifferenzen am Femur. Archiv. für Anat. und Phys., Anat. Abth., 1878, S. 364.

[5] Loc. cit.

[6] Arbuthnot Lane: Senile Changes in the Human Subject. Trans. Lond. Path. Society, 1886, p. 446.

[7] Ueber Osteohalisterisis, Wiener med. Presse, January 26, 1868.

it is a matter of common knowledge that bowleg is not at all uncommon in children who do not show a trace of disease—who are, in fact, exceptionally active, standing and walking at an early age —the bending of the bone being in such cases the effect of overweight.

It is, however, not the object of this paper to deny the possibility of rhachitis as the cause of this affection, but rather to place this particular deformity in the same class with the knock-knee and bowleg of adolescence.

The treatment, aside from that of the general condition, will be:

1. To remove the exciting cause—that is, overwork. It may be in some cases that simple cessation of the occupation will be sufficient; in others, and particularly the one-sided deformity, the long traction hip-splint, if the patient will permit, would seem to be indicated.

2. Local massage, exercises, and manipulation and passive motion in the direction of the restricted motion, on the principle of manipulation in the treatment of similar deformities of the knee and foot.

3. In the advanced cases osteotomy below the trochanter, on the principle followed in deformities at the knee, because the disability is caused by the adduction of the legs more than by actual shortening. By osteotomy, with consolidation, with the legs widely separated, one may, to a certain extent, replace the head of the bone in a relatively proper position and relieve the extreme outward rotation.

The diagnosis of the affection does not offer any particular difficulty at the stage in which patients usually present themselves. Marked prominence and elevation of the trochanter above Nélaton's line can be caused only by these conditions:

1. Displacement of the head of the bone from the acetabulum.
2. Change in the angle of the neck of the femur.
3. By upward enlargement or "wandering" of the acetabulum.

Dislocation may be congenital, in which case the patient limps from the moment that he begins to walk. It may be the result of traumatism, in which case the deformity and disability are instantaneous. It may be the result of sudden distention and rupture of the capsule by serous effusion, as in rheumatism; or by pus, as in acute arthritis or hip disease.

All these conditions may be excluded by the history.

In the absence of any history, the differential diagnosis between dislocation and bending of the neck of the femur is easily made.

In all cases of dislocation of the femur upward, if the thigh be flexed and adducted to its extreme limit, the neck of the displaced bone can be traced upward and the head of the femur made out, moving beneath the distended soft parts when the thigh is rotated. In bending of the neck of the femur nothing but the prominent trochanter can be felt. In all cases of congenital dislocation a certain amount of upward and downward motion may be obtained by pressure and traction of the limb; in bending of the neck this is impossible.

The neck of the bone may be depressed as the result of fracture, in which case there is a history of injury. It may be distorted by local disease—as osteomyelitis, osteitis, or necrosis—when there must be the evident signs of local disease, such as pain, swelling, suppuration, and constitutional depression. It may be depressed as one of the deformities of a general disease, such as osteitis deformans, osteomalacia, or general rhachitis. It is then but one of a series of deformities, and does not call for special comment.

Wandering of the acetabulum has only been observed after long-continued deformity and spasm of muscles, the result of confirmed hip disease, and the condition may therefore be excluded on the same grounds. It is evident that the only difficulty in diagnosis must arise at a very early stage of the affection from mild forms of rheumatism or hip disease. It is probable, however, that the progress of the deformity is coincident with the symptoms, thus differing from rheumatism, in which there is no elevation of the trochanter; and hip disease, in which elevation of the trochanter is a late symptom, occurring long after the diagnosis has been made.

In bending of the neck of the femur there is no local swelling or infiltration; the limitation of motion is in abduction and inward rotation; other motions are at this stage unlimited. In hip disease or rheumatism, when limitation occurs, it is in all directions, and accompanied by muscular spasm, which is absent in this affection.

The character of the symptoms, discomfort, stiffness, and pain about the trochanter and front of the thigh, increased by work and absent when at rest, is very different from the neuralgic pain of hip

disease, while chronic rheumatism in a young person, confined to one joint, must be a very rare affection.

Prognosis. Unchecked, the deformity shows a marked tendency to increase, as illustrated by Cases I. and II. Judging from Müller's three cases, the pain, disability caused by shortening and restriction of motion remains, but does not prevent the patient from following his ordinary pursuits.

Doubtless early diagnosis and treatment will, in patients willing or able to follow advice, prevent the further increase of the deformity. Osteotomy, I am sure, will remove the more serious disability, although it cannot be as effective as in the other deformities of the lower extremity.

DISCUSSION.

Dr. L. A. Weigel, of Rochester, asked Dr. Whitman if there were elements of rhachitis to account for the bending at that given point.

Dr. Benjamin Lee, of Philadelphia, asked whether in these cases there had been any evidence of a rhachitic condition, such as enlargement of the ends of the long bones.

Dr. A. J. Gillette, of Minneapolis, said he wished to report a similar case. A girl of ten years, weighing 115 pounds, had come to him complaining of some pain, and having a slight limp. These were the only symptoms, excepting that on attempting to abduct the limb she complained of considerable pain. The patient had been put on crutches and kept under observation. He was now inclined to think that this was really a case of bending of the femur. The cause of the bending in his case was probably the great weight of the patient's body.

Dr. F. S. Coolidge, of Chicago, asked if the early manifestations of rickets, particularly the corkscrew leg, and the bowing of the femur, had been present, and also whether in the cases reported there was apt to be the same change which apparently came on in the adolescent form.

Dr. R. Whitman said that the question which had been asked related to the etiology, a part of the paper that he had been obliged to omit in reading. Photographs of all the cases had been presented. Those who believed in rhachitis could look for it in these photographs. Although Müller had been inclined to believe that rickets was the cause of this affection, he would simply place it in the same class with knock-knee and flat-foot. Those who believe that rickets of adolescents is the cause of bow-legs and knock-knee could probably find the same evidences to account for bending of the neck of the femur; but as a matter of fact, none of these cases which he had reported did show any evidence of rhachitis. Everyone knew that certain rapidly-growing boys and girls had weak bones on account of their rapid growth. Improper surroundings and food might of course increase the weakness. This might be called rhachitis, but it was certainly not the typical rhachitis of childhood. There was no enlargement of the epiphyses. Of course, there might be late rhachitis, and in such cases there might be bending of the neck of the femur as one of a series of deformities.

He had spoken of weakness or slenderness of the bones as a predisposing cause; a certain depression of the neck of the femur in adolescence appeared to be normal, and if this were exaggerated by overstrain it was not difficult to believe that it would result in such a bending of the neck of the femur as he had described, or possibly great overstrain or slight injury might be the starting-point, but the point he wished to make was that the deformity was an affection of adolescence, belonging to the same class as bow-legs and knock-knee, conditions not infrequent in young people who were required to stand or carry weights. Bending of the neck of the femur in adolescence was quite different from the general series of deformities in weak and rhachitic children. He had examined a large number of rhachitic children, but had not found noticeable elevation of the trochanter, and it was very certain that restriction of abduction and the peculiar symptoms of the affection under consideration were entirely absent. In only one case of rhachitic deformity in childhood had he found the characteristic limitation of abduction.

RHACHITIC CURVATURE OF THE HEAD OF THE FEMUR.

By E. H. BRADFORD, M.D.,
BOSTON.

The specimen presented in the accompanying illustration shows a deformity which has received but little adequate notice, with

the exception of a few articles by German authorities, until Dr. Whitman's valuable paper.

The specimen was taken from an autopsy and there is no clinical

history. On examination it is seen that the head of the femur is irregular in shape, the neck short and bent, and the articulating facet unusual in its size and shape.

The acetabulum is also altered, the upper portion being much thicker than usual and more prominent. It will be seen that the head is less round than normal and more conical in shape. The round ligament has its normal attachment.

There is nothing abnormal in the appearance of the cartilage of the joint, except the unusual shape.

The external appearance of the bone suggest either a fracture occurring early in the life of the subject or the change due to the abnormal condition of the bone, allowing it to bend and become mishaped, as has been referred to in cases reported by Dr. Whitman.

There was nothing in the shape of the bone which would indicate a fracture. Furthermore, the alteration in the size of the acetabulum indicated a weaker condition of the bone; on section of the bone, which was carefully made, no evidence of fracture could be found.

THE LORENZ OSTEOCLAST.

By F. S. COOLIDGE, M.D.,
CHICAGO.

The difficulties of a correct understanding of Professor Lorenz's description of his osteoclast without seeing the apparatus itself, and the splendid results that he has obtained with it, are the reasons which led the reader to show the instrument to the Society at this meeting.

Although it is called an osteoclast, its use is far from being confined to osteoclasis alone. It is used for the correction of the deformities of the legs.

It consists of two strong vertical plates, one fixed and the other adjustable, so that between them the desired portion of the leg can be held in a vice-like grip. At a little less than a right angle with these is a horizontal screw with long handles, and to it is attached a stout leather strap which passes over the leg below the part held in the fixation plates. The long handles of the screw give tremendous leverage, and yet the thread is so fine that this enormous power can be controlled to a nicety. The fixation plates are covered with thick rubber, which prevents any injury to the skin at the points of pressure. The fixation plates and the screw form an angle of such a degree of acuteness that in osteoclasis the bending bone generally forms a right angle with the plates at the moment of fracture.

Used as an osteoclast, for the correction of genu valgum, the instrument possesses these advantages :

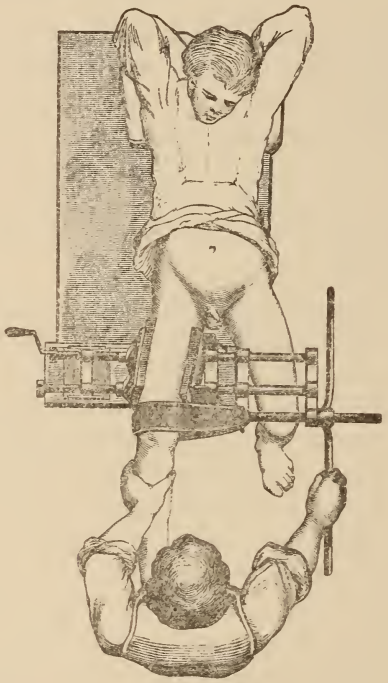
1. Its precision is so great that the bone can be broken within a fraction of an inch of the desired place, and in the supra-condyloid fractures it rivals osteotomy in its exactness.

2. That it fractures the bone in the desired direction—namely,

away from the deformity and toward the normal position, instead of in the antero-posterior direction, afterward necessitating manipulation laterally, as do the other osteoclasts which claim a precision sufficient for this operation.

3. That it can be worked with a minimum amount of force expended by the operator, not requiring the great exertions necessitated in the use of the Robin osteoclast.

4. That the power can be so nicely controlled that the fracture does the least possible damage to the soft parts, and, in fact, is generally a sub-periosteal fracture.



One point in Lorenz's after-treatment of these cases is worthy of notice. He applies the plaster bandages well up against the tuberosities of the ischii, and carries an iron extension below the feet and allows the patient to walk within a few days after the operation.

Lorenz makes no claim that the osteoclast entirely does away with the necessity of osteotomy. There are certain cases where

osteotomy and not osteoclasis is indicated, and he has pointed out clearly the class of cases in which osteoclasis is inadvisable.

But it is not in osteoclasis that the chief interest of this apparatus lies. Lorenz has shown that in genu valgum (knock-knee), of even a high degree, the external ligaments of the knee are capable of undergoing great stretching in a very short time without rupturing. And just as a club-foot can be stretched into place by forcible reduction without rupture of the ligaments and tendons, so knock-knee can be corrected, and even over-corrected, at one sitting, without rupture of the external ligaments of the knee. It is by means of the nicely-graduated power of his osteoclast that he has been able to do this in practically every case of knock-knee in which the main deformity lay at the knee-joint. This method is very different from brisement forcé. It is a gradual though rapid stretching of the shortened ligaments without rupture, or, as he calls it, "ein intraarticulare modelirerende redressement."

It is accomplished by securing the condyles firmly between the fixation plates, and applying the lateral force below the knee-joint, gradually increasing it, with frequent stops, until the external ligaments are so stretched that the limb is brought straight, or even in a position of genu varum, and then held until it requires only a little force to keep it in the corrected position. It is then secured in this position by a plaster bandage for six weeks, after which a walking knock-knee brace with a joint at the knee is worn constantly for a year. At the end of this time the joint structures have conformed themselves to the new condition, the lengthened external ligaments have recovered their strength, there is no longer any lateral movement in the knee (which is present immediately after the operation), the enlarged internal condyle has diminished, and the cure is complete, without any danger of relapse.

The pain after the operation lasts usually but twenty-four hours, and the patient is confined to bed but a very few days. Walking is then encouraged. This method corrects the deformity as quickly as osteotomy, and yet is not attended with its dangers, which though they may be slight, nevertheless do exist.

The writer had the opportunity of seeing Lorenz perform this operation a number of times and of seeing the results in several earlier cases, and they all certainly justified his statements.

In the rhachitic bending of the diaphyses of the bones of the leg of children there is still another application of the instrument. The inventor found that in many cases the graduated force could be so nicely applied that the bones could be bent straight until they remained straight, without fracturing. This stretching and bending of the bone without fracture he calls osteokampsis. It is possible in a large percentage of young cases, but after early childhood or after eburnation has taken place to any extent it is impossible. In anterior curvature of the tibia osteotomy should generally be performed.

In the consideration of the lateral deformities, thus far, the patient has been supposed to be lying on his stomach or back, accordingly as the left or right leg was to be corrected. But by placing the patient on his side the instrument becomes, to the writer's mind, one of the best means of forcibly overcoming the flexion deformities of the knee-joint.

With the anterior surface of the knee-joint pressed firmly against the immovable plate, the leather strap passes just under the head of the tibia, and, together with its powerful pull in overcoming the flexion, it drags the head of the tibia forward and overcomes the subluxation backward which is so constant and so difficult to correct in these cases.

In cases where the flexion equals a right angle, or even more, of course, the strap can at first get no hold upon the leg, and it is necessary to manually overcome the deformity somewhat before the strap can be applied. In ordinary cases the pain is of but short duration. Dr. Lorenz operated, in the writer's presence, on a boy of thirteen years, with flexion almost to right angle, resulting from old tumor albus. The leg was straightened to within three degrees and put up in plaster to secure it. On the next day the boy, when ordered to, arose from the bed and walked across the room, apparently without pain. Ordinarily, rest in bed three to five days and a support for some little time longer is the after-treatment.

In severe cases, when the patella is so firmly adherent to the femoral end that complete correction is impossible, the deformity is overcome as far as possible and an antero-posterior supra-condyloid osteoclasis is performed in addition.

The apparatus should be fixed on a sliding machine running up and down the legs of the table, so that it can be raised or lowered. In the flexion deformities of the left leg it is on a level with the surface of the table; but with the right leg it should be raised six inches or so, to bring it on a level with the right or upper leg.

In this connection the writer should say that recently Lorenz has modified his osteoclast, so that it is reversible; and that either right or left lateral deformity of the leg can be corrected with the patient upon his back.

Lorenz speaks of using the apparatus in the forcible reduction of club-foot, but the writer did not see him so use it, and has had no experience in such connection.

Case I.—A. R., aged four years. Severe genu valgum of both legs, with rhachitic deformity of spine and a bending of the shaft of the tibia. Operation in February, 1894. A MacCormac supra-condyloid osteotomy in the left leg and a redressement with Lorenz osteoclast in the right. The external ligaments were easily stretched, and the deviation of 35° from the straight line in the right leg was overcome, but there still remained some bending in the upper third of the tibia, and the bones were too eburnated to allow of osteokampsis.

The case is still under treatment, wearing a retentive apparatus.

Case II.—E. P., aged six years. Severe contractions following an extensive anterior poliomyelitis. Flexion of both knees and both hips, firmly held by the contractions. Operation, February, 1894. Subcutaneous myotomy with forcible reduction of the hip-joint flexion. Forcible manual reduction of flexion of right knee. The flexion of the left knee was about 45°, being greater in amount and firmer than in the right. Lorenz's osteoclast was applied, and in ten minutes the limb was perfectly straight.

The intensely nervous condition of the child and the development of a small pressure-sore from insufficient padding under the plaster bandage necessitated the removal of the plaster before a week was over, and to-day the left leg has five degrees of flexion, although the immediate results were all that could be desired.

DISCUSSION.

Dr. Gibney asked whether it was more difficult for the novice to manage this instrument than to perform a subcutaneous osteotomy. He had gained the impression from the paper that almost anyone could at once and easily learn to use the instrument. Subcutaneous osteotomy seems a very simple operation, yet the novice found considerable difficulty in managing the osteotome, and preventing it from injuring the synovial membrane.

Dr. T. Halsted Myers, of New York City, said that if it were necessary to wear a knock-knee brace for a year, very little would be gained, because most cases could be corrected without this instrument in the course of a year.

Dr. Ketch said he had previously claimed that much can be done by manual treatment, and this instrument seemed to show that such was the case. Dr. Coolidge had referred to the correction of bony deformities by gradual pressure. The gradual overcoming of rhachitic deformities the speaker considered a very valuable method of treatment.

Dr. Bartow said he thought we did not give all the credit that was due to the older osteoclasts. He had been using the Rizzoli instrument, and the bending of the bone could be effected very well with it.

The President said he had worked with Lorenz, and had watched the process of perfecting his osteoclast. Many cases of osteoclasis were done in the laboratory by Lorenz. The original object of Lorenz was to make an instrument which would enable him to put a strap on the upper end of the femur and produce osteoclasis near the trochanter. He knew of no instrument which would do this within two inches of the trochanter. This osteoclast just exhibited was nothing more than the osteoclast of Robin. With the latter instrument the patient was strapped to the table, and with a long lever the bone was broken. To the onlooker it was a tremendous operation. He had used the Rizzoli instrument

before any other osteoclast. If this instrument were made with a bar that would not bend it would be found to be an excellent instrument. Next to this he thought Grattan's osteoclast was the best, although Grattan's instrument was constructed very imperfectly. The speaker then exhibited a curved "jack," which he had suggested as a very important modification to the Grattan instrument. He thought that osteotomy should not be performed when osteoclasis could be done, for the reason that there had never been a death from osteoclasis, while an occasional death followed osteotomy. Osteoclasis should not be thought of where the bone to be fractured was near a joint, for separation of the epiphysis or rupture of the ligament might result. He had been very much interested in the cases presented to him by Lorenz at the time of his visit to him at Vienna a few years ago. Lorenz said that by rupturing the external lateral ligament with his instrument, or a similar one, and adopting the after-treatment already described, he had obtained good results; yet it seemed to him, the speaker said, from the pathology and etiology of genu valgum, knowing that the condyle was very much elongated, that it was not possible that the deformity could be removed without either osteotomy or osteoclasis in the shaft of the bone. He could not see how the Lorenz osteoclast was superior to the Grattan osteoclast.

Dr. Coolidge remarked that nothing had been said about the correction of the anterior and posterior flexion of the knee-joint, yet he considered that it was in these cases that this instrument which he had exhibited had done its best work. In the hands of a novice he thought it was considerably safer than the knife. In referring to the skill shown by Lorenz in its use, he had intended to refer more particularly to the rapidity with which he operated. The cost of the Lorenz osteoclast was about fifty dollars.

RUBBER HEELS FOR PATIENTS WITH POTT'S DISEASE.

By JOHN C. SCHAPPS, M.D.,
BROOKLYN, N. Y.

The exercise of walking acts not only as a direct traumatism to the diseased spine, but it is also injurious because it involves the expenditure of a large amount of nervous energy in the maintenance of constant muscular spasm as an automatic protection. This spinal rigidity appears to be protective only as against friction. The normal resilience of the spine being lost, the diseased area is more exposed to concussion and pressure than before. Only in the subacute or convalescent stage should patients be subjected to the traumatism of weight-bearing and that of walking, and even then a great amount of bracing is necessary to prevent motion and to diminish reflex muscular spasm. To minimize the concussion of walking, I have for the last two years been using heels of soft rubber attached to the shoes. I can report no specific results, but can, in a general way, say that this simple procedure seems to give considerable relief. The rubber should contain 65 or 75 per cent. pure gum. The heels must be attached by cement and stitches, and not by nails, and the stitches must pass through the edge of the rubber and not over the surface, where they would be exposed to wear. The rubber should be one-half to three-fourth of an inch thick, and have the front edge beveled off to diminish the danger of the patient catching them, and so being thrown down. I have recently seen in the market rubber pieces to be attached to leather heels, but they are too thin and too hard for our purpose, and are to be nailed on. An air-cushion heel has been suggested, but I have not yet tried it.

DISCUSSION.

Dr. Foster, of Boston, asked if in cases in which the spine was so sensitive, it would not be better for the patient to be in bed?

Dr. Ketch said that some years ago he had made some experiments with the same idea. Instead of having the ordinary leather shoe going onto the foot, he had had rubber applied; but he had been unable to observe any great benefit from it. Of course, his were not quite similar cases to those described in the paper.

Dr. Ryan thought the rubber exhibited by the writer was too hard, for firm pressure made by the hand showed that it possessed comparatively little elasticity.

Dr. Ketch asked at what stage these rubber heels were used? It was, of course, well known that these patients with sensitive spine, if allowed to walk, were very careful about how they walked, in order that they might avoid concussion so far as possible.

Dr. Schapps said he thought that persons with very sensitive spines were better off in bed; but if the spine were sensitive enough to require a brace, it was advisable to avoid concussion by using these rubber heels. It was to relieve these patients of the muscular effort, for their own protection, that he had used the rubber. He had found it very difficult to get any softer rubber than that shown. This would not show much elasticity, of course, from slight pressure, but it was very different when it was subjected to a pressure of fifty pounds or more. He employed the rubber heels in all stages. The use which Dr. Kelch had made of rubber, as he understood, was on the end of a hip-splint, to equalize traction.

A CASE OF ANKYLOSIS OF THE JAW IN A CHILD; RESECTION; RECOVERY, WITH GOOD MOTION.

By DILLON BROWN, M.D.,
NEW YORK.

The patient was a boy, eleven years old, and was seen by me for the first time on November 12, 1887. He then had a firm, apparently bony, ankylosis of the jaw, so that there was practically no motion, and he could take nourishment only in the form of liquids or soft mushy food, both on account of the limitation to motion of the jaw preventing him from chewing, and on account of the fact that the jaw was ankylosed in the closed position, and he could take only such food as could be pushed into the mouth between the closed teeth and the opening made by a tooth which had been removed.

According to the parents this condition was the result of a swelling in the left side of the neck, which appeared when he was an infant six months old. This swelling was opened and a large amount of pus evacuated, but it continued to discharge for a number of months. Since that time he has been unable to open his mouth. He had a discharge of pus from the right ear, which ceased in three weeks, and since then he has had no other sickness.

His present condition is as follows: General health fairly good, but rather poorly nourished. On both sides of the neck there are a number of enlarged lymphatic nodes, both in front and behind the sterno-mastoid muscles. There is only the very slightest motion in the jaw, and this is chiefly lateral. The lower jaw, on both sides, is atrophied, so that he has a retreating chin, which gives a weak appearance to his face. There is marked deviation of the tip of the chin toward the left side on account of the

greater atrophy of the jaw on the left side. The descending ramus of the left side has a depression over it, and looks and feels smaller than the right, but no difference could be made out on ordinary measurement. On both sides the distance from the angle of the jaw to the tip of the chin was three inches; however, the distance from the angle of the jaw to the joint was three-eighths of an inch less on the left side—the distance being two inches and two and three-eighths inches respectively. There was no evidence or history of necrosis.

All kinds of wedges, gags, and levers were used in attempts to open the mouth, but without the least benefit. Therefore, in the early part of April, 1888, at my request, Dr. A. M. Phelps resected the left temporo-maxillary joint. There was complete bony ankylosis, and the operation was rather difficult on account of its deep location and the necessity of removing the bone with a chisel. He made a good recovery. On the fifth day passive motion was begun, and in two weeks he left the hospital with very good motion, and for the first time in his life he could chew food. One year later the motion was excellent, and he had evidently made a permanent recovery.

AMPUTATION OF BOTH LEGS AT KNEE-JOINT FOR PARALYTIC CLUB-FOOT IN A CASE OF SPINA BIFIDA COMPLICATED BY CONGENITAL INGUINAL HERNIA:

In which the Testis and Appendix Vermiformis were Removed during an Operation for its Radical Cure.

By WILLIAM J. TAYLOR, M.D.,
PHILADELPHIA.

Amputation at the knee-joints of both lower extremities for congenital paralytic club-foot is seldom found to be necessary as an orthopedic measure, for conservative methods of treatment by means of braces, and, if need be, tenotomy, with some one or more of the operations upon the tarsal bones, usually accomplish good and lasting results. Occasionally, however, the deformity is of such a character, and the resulting disability so great, that no form of appliance or conservative operative procedure will give the desired results. Under these conditions amputation, followed by properly fitting and accurately adjusted artificial limbs, is our only means of positively benefiting the patient, and the more radical procedure is therefore the one to be selected.

A detailed account of one case where this mode of treatment was carried out with the happiest results will, I trust, prove of interest.

This little patient, a boy aged six years, was admitted into the Orthopedic Hospital and Infirmary for Nervous Diseases under the care of Dr. W. W. Keen, and it is through his kindness that I am able to make this report.

As assistant surgeon to the hospital I have been enabled to assist Dr. Keen in the performance of all of the operative proced-

ures here described, and much of the subsequent care and treatment has been intrusted to me.

I have nowhere been able to find recorded an instance of similar deformities, and the remarkable number of serious surgical operations which this patient has passed through in perfect safety, and with comparatively little shock and suffering, marks his case as unique.

His father, mother, three sisters, and one brother are all living and in good health, and there have been no other cases of deformity in the family. He is the third child born to the mother, and during pregnancy she remembers having had a severe fall, and suffered a great deal of pain during the remainder of the time she was carrying him. Labor was normal, but very painful, and the boy was born with the deformities about to be described. He has always been well, with the exception of an attack of chicken-pox and one of la grippe. All parts of the body, with the exception of the lower limbs, developed as in other children, and he began to crawl at about the average age. His mind developed as rapidly as in the case of the other children. He is a well-nourished child; all the organs are in good condition, except, however, incontinence of urine and feces. The head, chest, and upper extremities are normally developed. The laminæ and spines of two of the lumbar vertebræ are absent, and there is a small soft tumor over this site, showing a spina bifida.

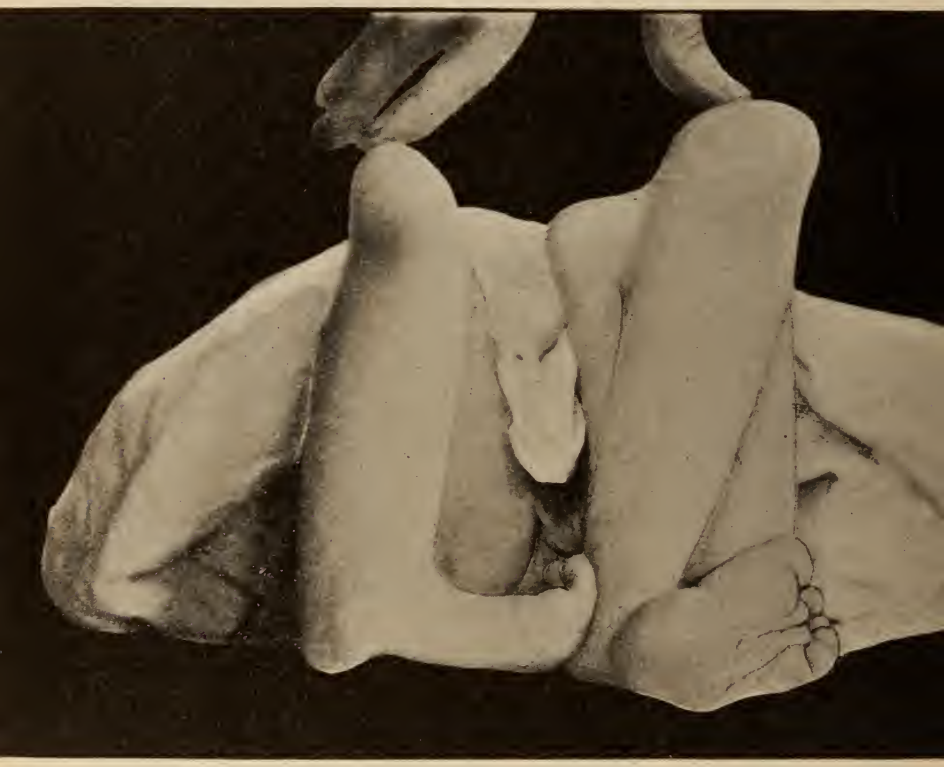
He has also a complete congenital inguinal hernia on the right side.

The right hip is normal in size and shape, the right femur is normal at the hip-joint, but gradually tapers toward the lower end to a mere blunt point, with an absence of the condyles. The muscles of the thigh are poorly developed, especially toward the knee-joint. There are two bony knobs on the inner side about the middle third of the thigh; these were thought not connected with the femur, as the skin moved freely over them. The patella is absent. the tibia is dislocated backward and upward upon the femur. It may be completely flexed, but can only be extended to a right angle. The fibula is absent, and the muscles of the leg are much wasted. At the ankle-joint there is a dislocation backward and upward. The foot is inverted, and the toes point inward. The

great toe is absent. The pulse in the dorsalis pedis is easily distinguished.

The left hip-joint is normal, and the femur is normal to its lower third, where it bifurcates, and there is a knob of bone projecting down and inward. The external portion takes the course of the

FIG. 1.



Taken while the patient was lying upon his back in bed, as it was impossible to extend the legs further than a right angle.

natural bone to form the knee-joint. The condyles are very small, and the patella absent. The knee is dislocated backward and upward, and is flexed, making an angle of about 60° when fully extended. There is a small fibula which turns around the tibia until it comes in front of it at the ankle, the external malleous being in front. The foot is in extreme talipes varus, the toes

pointing inward, while the sole of the foot is turned upward. The left leg is a little larger than the right, and there is slight motion in the left knee-joint. The ankle-joints have no motion on either side, while the motion at the hips is almost perfect. Sensation in both limbs is good, and the electrical conditions of the muscles are normal.

Fig. 2.

Showing the condition of the legs and feet after their removal.

His manner of moving from place to place is to sit upright upon the floor, with all parts of the lower extremities flexed. He then leans his body forward and places his hands upon the floor as far as he can reach, and brings his body up to his hands. In fact, he swings his body, using his arms as one would a pair of crutches.

As his legs and feet were perfectly useless appendages, with no

possible hope of their ever becoming serviceable, either with the aid of appliances or by operative measures, it was decided, after very careful consultation, to remove them by amputation, and apply in their stead accurately fitting artificial limbs.

It was at first thought that amputation in the middle third of the legs would be best, as being the most favorable point for the fitting of artificial limbs, and thus allow the knee-joint to receive the pressure. The internal knob of bone, or bifurcation of the femur, and the pieces of bone on the right thigh were to be removed at the same time, as they would interfere with the adjustment of the artificial limbs. It was deemed best to operate in instalments, and to permit him to recover thoroughly from one operation before attempting another.

Accordingly, the first operation was performed January 4, 1893. An incision was made over the knob of bone which projected from the inner side of the left femur, and the skin and fascia dissected off. This was found to be a pear-shaped piece of bone projecting from the femur about three inches above the knee on the inner side, and united to it by bony union. This projection of bone was three-and-one-eighth inches long by one-and-one-sixteenth inches in diameter. The portion which was attached to the femur was about three-quarters of an inch in diameter, forming a neck; a small bursa covered the tip of this prominence. This was removed by sawing through the neck and smoothing heads with cutting forceps. The artery passed behind this knob of bone, and was exposed in the incision, but was not wounded. In view of the character of the tissues it was found impracticable to amputate through the leg as at first proposed. An incision was then made over what would ordinarily be the external condyle of the femur, down and around the front of the tibia, and up to the inner condyle of the femur. This flap was dissected back, the tibia disarticulated at the knee, and a smaller posterior flap cut from the skin. The wound was dressed with sterilized gauze, while a small piece of gauze was introduced between the lips of the wound for drainage. This healed without special incident other than a considerable discharge of serum, which came apparently from a portion of the synovial membrane of the bursa, which had not been thoroughly removed at the time of the operation.

On March 3, 1893, the stump of the left leg having thoroughly healed and being in perfectly healthly condition, the right leg was amputated at the knee-joint by a similar incision to that used at the former operation. Two knobs of bone about three-quarters of an inch in diameter were found on the inner and middle third of the thigh. The incision was enlarged from its inner angle, and these projections of bone removed by a chisel and rongeur forceps.

FIG. 3.

The condition of the stumps after complete recovery from the amputations, with the scars made in the removal of the projections of bone. It also shows very accurately the hernia.

They were found to be connected with the femur by ligamentous attachments only, and the abductor magnus muscle was attached to them. They were removed with great difficulty, and in so doing the deep femoral artery was cut, as it lay immediately in contact with them. This was, however, easily ligated, and the amount of blood lost was small. A drainage-tube was inserted and the wound closed and dressed with aseptic gauze. He made a perfect

recovery, with no ill effects whatever, from these two severe operations.

It was found impossible to reduce completely the hernia and to apply any sort of truss which did not give pain by its pressure. As artificial limbs were to be worn, a further appliance in the shape of a truss encircling the waist was not to be thought of. Therefore, on May 24, 1893, after thorough preparation of the parts, Dr. Keen operated upon the hernia, his intention being to

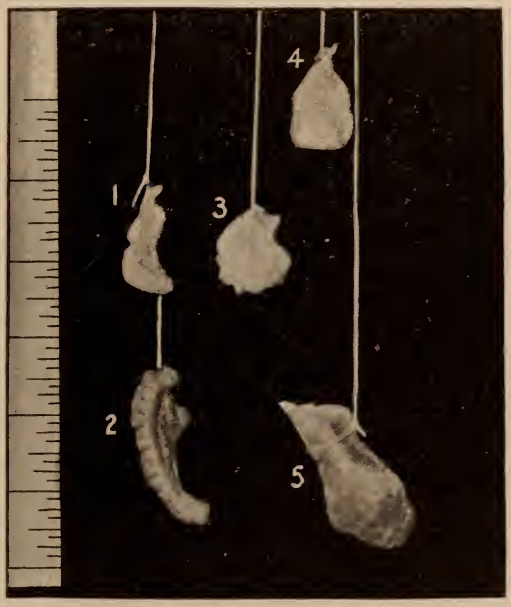
Fig. 4.

The application of the artificial limbs.

use Halsted's modification of Bassini's method. An incision four inches long, parallel to and three inches above Poupart's ligament, was made, and the sac opened. Several organs were found in the sac—the appendix vermiformis, bowel, testicle, and cord. The appendix was three-and-one-eighth inches long. It was ligated with silk, and the lumen of the stump disinfected with pure carbolic acid. The stump was then invaginated and covered by bringing the serous surfaces together. The testicle was then removed,

as it was much atrophied and adherent to the sac, and the sac torn loose and sewed together, the excess of the sac having first been cut off. The appendix, when removed, was much longer than normal, and was attached at its tip to the walls of the hernial sac. When examining it after its removal, a small piece of tough vegetable material was squeezed out of its interior. This appeared to be a small bit of apple skin, but there were no evidences of inflamma-

Fig. 5.



1. Testes. 2. Appendix vermiformis. 3, 4, 5 Bony growths removed from the thighs.

tory mischief to its lining mucous membrane. The pillars of the ring were sutured, and lastly, the skin. A gauze and iodoform collodion dressing, thoroughly sealing the wound, was applied, with an ample covering of gauze dressing. An inverted Y-shaped splint was then applied to the spine, extending downward; to this both thighs were firmly bandaged, to prevent all movement and enable the wound in the loin to close by primary union. From this operation also he recovered without a bad symptom. There

was very little shock, from which he reacted rapidly, and his convalescence has been perfect.

From all of these serious and necessarily prolonged operations his rapid recovery was truly remarkable. At no time was his condition such as to cause any alarm, and his temperature chart showed a most gratifying absence of fever. He was perfectly calm and cool throughout, never crying when taken to the operating-room, or manifesting that fear so common to all children, as, indeed, to most adults.

On July 13, 1893, artificial legs were fitted, and by July 25th, by a little careful adjustment, he was able to walk around the ward with the aid of a chair, which he pushed in front of him, and in a short time to walk with the aid of crutches, and then with only a cane.

He can now walk alone and without the aid of crutch or cane, although as a measure of precaution, in moving about upon our polished floors in the hospital, he uses one crutch for security.

These photographs were taken in part by me and in part by Dr. Boyer, the resident surgeon, and show very accurately the deformity of the legs and feet before the operation.

No. 1 was taken while he was lying upon his back in bed, as it was impossible to extend the legs further than a right angle.

No. 2 shows the condition of the legs and feet after their removal.

No. 3 shows the condition of the stumps after complete recovery from the amputations, with the scars made in the removal of the projections of bones. It also shows very accurately the hernia.

No. 4 shows the three bony projections removed, as well as the atrophied testicle and the enlarged and thickened appendix vermiformis.

No. 5 shows the application of the artificial limbs, which were only made after the most careful and painstaking adjustment by Mr. Osborne, their maker. As will be seen, it was necessary to bring the knee-joint much further forward than is usual, to compensate for the want of complete control of some of the muscles of the thigh, and to enable him to balance perfectly. Elastic running down the shin bones was necessary to provide sufficient resistance to permit the extension of the legs in walking.

OLD AND NEGLECTED DEFORMITIES FOLLOWING INFANTILE SPINAL PARALYSIS.

By STEWART LEROY McCURDY, M.D.,
PITTSBURG, PA.

The orthopedic specialist seldom sees a case of anterior poliomyelitis of infants during the acute attack, and he is seldom called until marked deformity exists. If a specialist is called to consult with the general practitioner during the early course of the trouble, it would very naturally be the neurologist instead of the orthopedist. These cases are found almost everywhere. In every small town you will find what the local profession will say are hopeless incurables, either crawling about on their hunkers, or hauled about in carriages, etc., and the friends of these unfortunates take it for granted that nothing can be done for them. On the contrary, they are the cases that are the most promising, and the deformity is the most quickly corrected. By this I do not mean to convey the idea that the surgeon experiences no difficulty in the cure of this trouble, but as compared with other classes of deformities; for instance, of a congenital talipes equino varus and a paralytic equino varus of ten years' standing, the latter deformity can be more promptly corrected. In the congenital deformity mechanical treatment will generally be relied upon, and the stretching of tendons by appliances, and holding them in position by the same method, is a procedure that requires time. In the paralytic cases, on the other hand, mechanical treatment is out of the question, and the operative treatment must be resorted to. By the operative treatment I do not mean that in cases of subluxation at the knee an osteotomy is always necessary, or indeed is it always necessary to do an osteotomy; or in an old case of club-foot, it is but rarely necessary to remove a wedge-shaped piece of the foot, or to enucleate the astragalus.

The general surgeon is more likely to correct the deformity at one sitting; the instrument maker, in whose hands these cases very

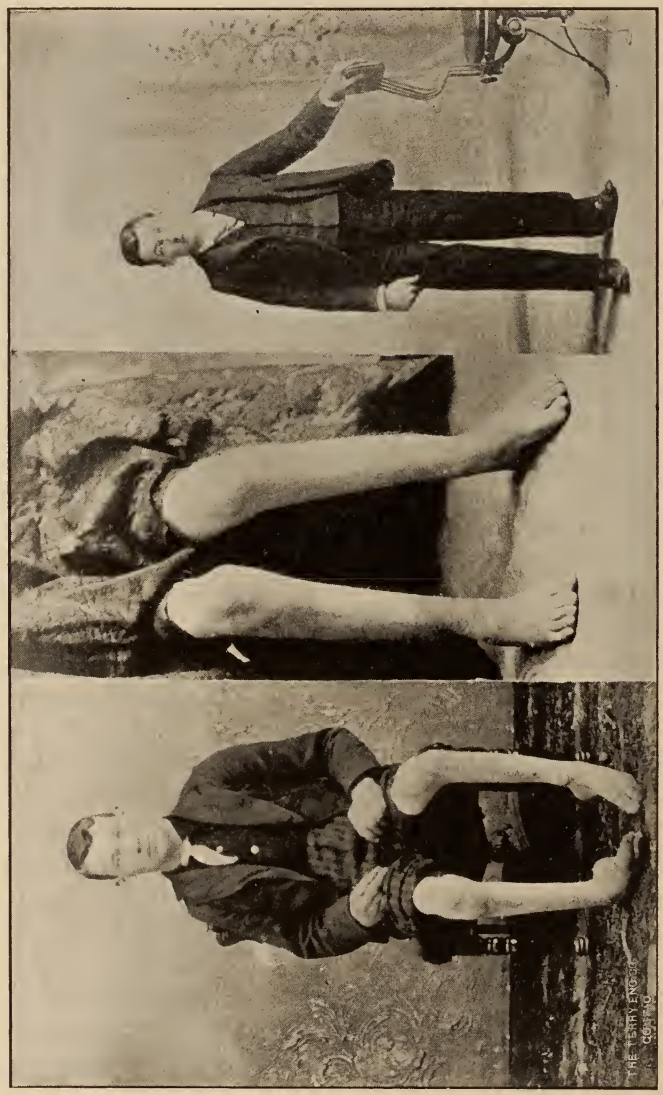


FIG. 1.

frequently fall, depends upon braces entirely. The orthopedist fills in the chink between the general surgeon and the bracemaker, and

gives patients the benefit of both of the foregoing extremes, and, in addition, bridges the chasm that must necessarily otherwise exist.

It is seldom necessary to destroy the bony continuity of a foot, even in the worst cases of talipes, but it is a common occurrence for general surgeons to do a cuneiform osteotomy through the tarso-metatarsal joint, or to enucleate the astragalus. But subcutaneous tenotomy and a Thomas wrench are generally sufficient. It is seldom necessary to more than do a subcutaneous tenotomy of the hamstring in subluxation dependent upon false ankylosis, but the general surgeon would expect to completely restore the limb to parallelism at one sitting, regardless of the extent of the operation.

Experience has demonstrated to me the wisdom of making haste slowly in the restoration to the normal of joints that have been in abnormal positions for years.

Case I. Fig. 1, A.—M. C., aged seventeen years. When two years old had an attack of anterior poliomyelitis with sudden onset,

Fig. 2.

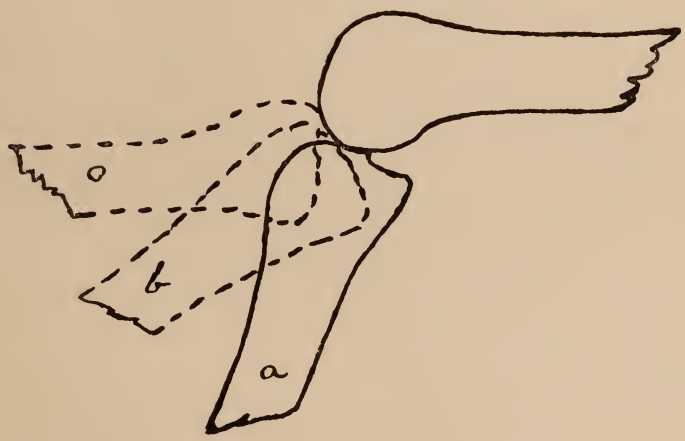
high fever, convulsions, etc., after which he was completely paralyzed, *i. e.*, paralyzed of both upper and lower extremities. This paralysis was continuous until he was about four years of age, when he began to

have some use of his arms and legs. The right arm gained more rapidly than the left, and the left arm more rapidly than the lower extremities. When treatment was begun, fourteen years after the onset, he was crawling around on his hunkers, as he had been for all these years, except during the past two or three, when he had been riding in a tricycle. As shown in Fig. 1, A, he had an exaggerated talipes equino varus of the right foot, which could not be corrected by manipulation, and a subluxation of the left knee at an angle of 45° (Fig. 2). Owing to the fact that the deformities had existed for so many years, the bones were held in their abnormal position by dense adhesions. The rule to which prominence has been given by Phelps, viz.: cut every tissue that offers resistance, beginning with the tissue that offers the greatest resistance, and continue to cut until the foot can be returned to a super-corrected or at least corrected position, was observed as nearly as possible. Under A. C. E., the tendo Achillis was first tenotomized; the plantar fascia next, and, finally, the deltoid ligament had to be completely severed before the foot could be approximated to the normal. The Thomas wrench, or twister, was used to break up adhesions and rupture the shortened ligaments about the tarsal bones. Great force had to be used with the twister to do this. The tenotomies were done subcutaneously, of course. In dividing the deltoid ligament, an artery, possibly a continuation of the posterior tibial, or at least a considerable branch, was cut, but as the cutaneous puncture was about an inch from the point of injury to the artery, pressure soon controlled the hemorrhage. The astragalus, which had been, of course, dislocated during all these years, could not be reduced, *i. e.*, could not be pushed back between the tibia and os calcis.

Phelps' open operation occurred to me, but was not demanded, because, had the plantar surface of the foot been laid completely open the ligamentous resistance to the return of the astragalus would not have been removed. Enucleation of the astragalus as practised by many, and notably Gibney, was considered, and would doubtless have been performed but for the fear that some detail in cleanliness had been neglected (the operation was done at the home of the patient). The foot was brought as nearly to a normal position as possible, but was not super-corrected by any means, and put up in plaster-of-Paris. The skin punctures were dressed with gauze and

protective. The plaster-of-Paris dressing was renewed once a week, and the foot held to the extreme point of correction until the plaster was hard. After each adjustment of the plaster the patient suffered great pain in the joint in the region of the astragalus for an hour or so, but he invariably noticed "something slip," and the pain was relieved. As this slipping occurred after every dressing, it was evident to my mind that the astragalus was wedging itself back between the tibia and os calcis, and the forcible correction maintained thus by the plaster caused the soft structures to yield. The success we had in effecting a reduction of the astragalus can be determined by examining Fig. 1, B. The patient was also given massage, electricity by the Faradic current, and gymnasium exercises. To carry out the latter, two poles twelve feet long were rigged up in his room, placed high enough to support his hands and allow his feet to rest on the floor. At first he was given five minutes morning and afternoon, and the time was extended two minutes daily up to one hour in the forenoon and one hour in the afternoon. Result of treatment is shown in Fig. 1, C.

Fig. 3.



The subluxation of the left knee-joint, in Case I, Fig. 1, A, and Fig. 2, required tenotomies of the hamstrings and forcible breaking up of the adhesions between the bones and about the joint. It was impossible to correct completely the deformity here, as in the case

of the foot, *i. e.*, a parallelism could be had between the thigh and leg, but the leg was upon a lower plane than the thigh. This was due to the fact that the head of the tibia did not slip down and forward upon the condyles, but instead the relationship of these bones was not disturbed. The condition that existed is shown in Fig. 3, *a* representing the condition before correction was tried, and *b* and *c* the condition as the bones were brought parallel, which, as may be observed, increases the pressure of the anterior surface of the tibia against the condyle of the femur, and thus prevents the head of the tibia from gliding forward over the condyles of the femur.

Immediate reduction of subluxation of the knee joint is prevented, first, by the adherent patella and synovial membrane to the condyles; second, by the impinging of the anterior portion of the head of the tibia against the condyles. In cases where the hamstrings are not cut, this burrowing in of the bones upon each other is much greater, and an immediate reduction is less likely to be effected.

Gradual and continuous leverage offered the best means for correcting the deformity mechanically. After the severe manipulation and tenotomies, the joint was put up in plaster-of-Paris and kept there for about three weeks, or until all inflammation had subsided. At this time very little progress had been made toward restoring the normal relations of the joint. A perfectly plain splint was used, to which the leg was bandaged, and the knee was drawn down as close to the splint as possible, or to the tolerance of the patient. This was tightened about every other day, or as often as was necessary to keep the bandage tight. Here, as was experienced after forcible correction of the talipes, the patient experienced a slipping or letting loose in the joint, and the pain caused by the forcible correction was relieved thereafter.

The success we had in the treatment is shown by comparing A with B and C, Fig. 1, taken six months apart.

Case II.—Samuel M., aged seventeen years. Had an attack of anterio-poliomyelitis at four years of age, resulting in talipes equinus in both feet, the right foot being worse than the left (see Fig. 4, A and C).

The case came to my clinic at Ohio Medical University, Colum-

bus, Ohio, January 12, 1893, and was sent to the Protestant Hospital for operation. Operation required tenotomy of tendo Achillis and plantar fascia of both feet, and forcible breaking up of adhesions about the tarsal bones with a Thomas wrench. The feet were put up in plaster-of-Paris, and new dressings reapplied once a week for four weeks, when the patient was able to walk home on crutches. Fig. 4, A, shows the right foot before, and B after treatment, and C shows the left foot before, and D after treatment. The patient always used crutches before treatment, but has no need of them since. Recovery practically perfect.

FIG. 4.

CASE III.—Clarence G., aged nine years. When eleven months old he had fever and severe convulsions. While yet in his mother's arms she noticed that he was completely paralyzed on his left side. He had been able to walk before the attack of anterior poliomyelitis, but it was about one year after before he began to creep, and he did not get upon crutches until three years later, or when about five years old. For the succeeding four years he walked with crutches. (See Fig. 5.) Operation consisted in tenotomies of tensor vaginæ femoris, fascia, etc., to liberate the thigh at the hip-joint, and of the hamstrings to correct the subluxation and flexion at the knee. The tenotomies were done subcutaneously. The patient was put up in plaster-of-Paris from the thorax to the heel, and allowed to remain so for about two weeks. In order to make the plaster dressing lighter and less likely to break over the hip and under the knee, pieces of iron were put in over these joints, as is the practice

in the New York Institute for Ruptured and Crippled. (The case is shown in Figs. 5, 6, and 7.) As a retaining splint, shown in Fig. 6, after the first few weeks, he wore a Thomas hip-splint with an outside piece riveted to rings at thigh and calf and fastened to the foot at the heel. It was also necessary to use an abduction

Fig. 5.

arm, see Fig. 6, owing to the great tendency to that deformity. The patient now has entire control of the hip. The brace was cut off at upper end of the double bars, or at thigh ring, which removed all support to the hip-joint, and the lower, or knee portion, was used. He can walk without crutch or cane.

Hilton gives us an anatomical law that the nerve that supplies a joint also supplies the muscles that control the motion of the joint and the skin which covers the same. The force of the law is demonstrated in many pathological conditions, but very forcibly in paralytic deformities. When joints are in deformed positions, the trophic nerves distributed to the muscles controlling the joint do not perform their function normally. When a joint which has been in an abnormal position for years is restored to a normal position, the power of the nerves to perform the trophic function is increased,

and the muscles that have shown no signs of development for years begin to increase in size and strength. A remarkable development of muscles was shown in this case, as I have observed in others.

FIG. 6.

FIG. 7.

The rule is that after a plaster-of-Paris cast is adjusted it gets loose in a few days; but just the opposite condition has always been observed in all my paralytic cases.

SUMMARY OF TREATMENT.

- Operative:
  1. Tenotomy.
  2. Osteotomy, rarely.
  3. *Brisment forcé.*
- Mechanical:
  1. Retentive
     - Plaster-of-Paris and other splints.
     - Braces.
  2. Corrective
     - Gymnastics.
     - Massage.
     - Manipulation.
- Electricity.

TREATMENT OF PARALYTIC DEFORMITIES.

By DE FOREST WILLARD, M.D.,
PHILADELPHIA.

I SHOULD not have ventured again to bring before the members of this Association the subject of relief of paralytic deformities had not the President invited me to take part in the presentation of this topic.

My views in relation to this matter have been already published in the *Transactions* of the Tenth International Medical Congress at Berlin, in the TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION for 1891, and in other places. I can only say that each year's experience convinces me more thoroughly of the truth of my conclusions, namely, that all deformities consequent upon infantile spinal paralysis or cerebral spastic palsy, even of severe grade, can be either ameliorated or very markedly benefited by surgical and mechanical measures. Many of the so-called hopeless grades can be made capable of comfortable and self-helpful locomotion.

The amount of benefit to be derived from operative and mechanical measures depends upon the severity of the paralytic process; yet the cases in which improvement is impossible are few. The worst cases are those spastic ones in which the brain power is insufficient to energize the muscles, and those extreme cases of spinal paralysis in which total loss of power is present and the limbs are flail-like.

All the minor grades of infantile and spastic disease are represented chiefly by flexions at the knee and hip and by various distortions at the ankle. These flexions are the result of neglect during the progressive stage, and can be prevented by the early use of apparatus. To attempt to relieve these flexions by mechanical

means alone is barbarous, as it inflicts great pain upon the individual, and in the majority of cases proves inefficient. To attempt to elongate densely contracted tissues is tedious and painfnl, as it can only be accomplished by increased growth (the structures being incapable of actual elongation) and even when accomplished the resultant member is in no wise stronger than that obtained by tenotomy; consequently the decision is overwhelmingly in favor of surgical measures.

Subcutaneous tenotomy in the hands of a proper surgeon is a safe and scientific operation resulting in the securing of a movable and useful limb, and is a procedure in every way desirable.

Flexion at the Hip.—It is so difficult to obtain a grasp upon the pelvis sufficient to permit of even moderate extension that section of the muscles becomes eminently advisable. Division of the tensor vaginæ femoris and the surrounding fascia with the sartorius and the long head of the rectus is perfectly feasible by the subcutaneous method; but when further division is necessary the open plan should be selected. Fascial contractions frequently extend close to and beyond the anterior crural nerve and even to the sheath of the femoral artery. Of course no one could be rash enough to attack the psoas and iliacus subcutaneously.

The obstacles to extension are very largely fascial. Of course all the laws of thorough antiseptic surgery must be observed. I have frequently made very extensive and very deep subcutaneous sections without one particle of severe resultant inflammation. The effused blood speedily vanishes.

In spastic cases the division of the adductors is very frequently necessary, and subcutaneous section is possible and safe. An open wound so close to the genitalia, especially in the more or less enfeebled brain conditions so often associated with this complaint, is specially undesirable. The tenotome puncture, however, should be made through the skin as far as possible from the vulva or penis, the integument being drawn toward the median line of the body before the puncture is made, in order to increase the final distance. The bleeding is frequently free; but if the section is made close to the pubic ramus, although the larger branches supplying the adductors may be cut, I never remember having seen any serious hemorrhage, nor has suppuration followed.

The dressings following section for flexion may be either adhesive plaster with weight and pulley extension to the legs, where it is desirable to overcome the condition of lordosis, or a gypsum dressing encasing the trunk and legs.

In spastic cases the adduction of the thighs is best overcome by forcible abduction following myotomy. The dressing which I have found more effectual and comfortable than the bar between the knees and thighs is simple fixation of the knees in a straight position by plaster-of-Paris dressing sufficiently heavy to maintain extension of the hips and thighs, while the feet may be fastened widely apart to the outer sides of the bed, thus compelling the gap in the muscles to be filled with fibrous tissue, which subsequently rarely contracts. In young children the weight alone is sufficient to restrain the muscles from contraction. When division of the hamstring tendons has been made these dressings answer a double purpose. All inter-femoral dressings lose their power and become useless as soon as the thighs are flexed.

Flexion at the Knee.—Deformities at the knee are usually in the direction of flexion, whether with or without posterior displacement of the tibia. Occasionally, when a spinal paralysis is of long standing, the anterior portions of the condyle may become so elongated that restoration of the normal position is impossible; in such cases excision, with fixation of the joint in the straight position, becomes highly advisable for walking purposes. It is still a question whether this fixation of the knee in individuals who cannot afford apparatus does not give the best form of walking member. It is certainly advisable in cases already indicated.

In excision I prefer to fix the bones with a temporary suture of strong chromicised catgut. This secures good apposition until inflammatory adhesions have taken place. This material is not open to the objections which are usually urged against silver wire, ivory pegs, or steel nails. Silkworm-gut is also practically non-absorbent.

Tenotomy of the hamstring tendons can usually be practised safely and subcutaneously. When the fascial contractions extend to the popliteal space, or when unrelieved by subcutaneous section, open incision is advisable.

In spastic cases the lengthening of the tendons is very desirable,

and when followed by manipulation, and exercise by locomotion, contraction rarely takes place. Even should this occur, a second division will usually permit of complete straightening of the limb.

Flexion at the Ankle.—Subcutaneous division of all the contracted tissues is the rule in contractions at the ankle. The foot should be placed in good walking position, in its normal relation to the bones of the leg. Forcible straightening should immediately follow the sections, and the parts should be temporarily retained in position for two weeks by gypsum bandages, after which an apparatus properly constructed should be worn to prevent a return of the deformity.

In spastic cases, tenotomy for the relief of equinus, giving a normal broad base for locomotion, is marvellous, and results in great gain in the muscular power of the individual. As I have said, the only obstacle in the way of success is deficient brain power.

Subsequent help to locomotion must be carefully planned, and with the judicious employment of elastic straps, steel springs, lock-joints, stop-joints, etc., together with crutches or canes, or wheeled crutches, walking can be encouraged, and a helpless pair of legs can be greatly developed. Crutch-heads can be conveniently fastened upon the frame of a wheeled-chair, baby coach, or child's express wagon, and an encircling belt will prevent many a fall.

An overhead supporting trolley-wheel, with suspension by leather jacket, will assist greatly in giving confidence and in developing leg motion. Much patience is necessary on the part of the patient, the attendant, and the physician.

Conclusions.—1. Prevention of deformities by means of apparatus and other measures is exceedingly important.

2. When contractions have occurred the employment of surgical measures should, as a rule, precede the application of mechanical appliances. To attempt to overcome these deformities by mechanical means is to needlessly inflict great pain and consume much time, and the final result is no better than when surgical procedures are employed.

3. Myotomy and tenotomy, either subcutaneous or open, are perfectly safe operations; they are usually remarkably effective, and leave the muscles in a better condition for maintaining parity of action than before the operation.

4. In contractures of the hip free open incision is usually preferable; at the knee, subcutaneous section can frequently be performed; but when fascial contractions occur in the central popliteal space open incision is necessary. At the foot, subcutaneous division usually is sufficient; tarsectomy is seldom necessary. Fasciotomy is frequently required.

5. Forcible straightening following division is usually necessary. Thorough rectification must be secured at the time of operation, and all contracted tissues should be divided.

6. In spastic paralysis, lengthening the tendons by tenotomy assists in restoring muscular equilibrium, and consequently secures better subsequent locomotion.

7. Free section of the adductors is often necessary.

8. The best subsequent dressing for maintaining abduction while the patient is in bed is the application of a rigid dressing to the knees. The legs can then be fastened widely apart.

9. Mechanical appliances subsequent to operation with lock- or stop-joints are frequently temporarily needed, and artificial support by crutches, wheeled-crutch or other measures will assist in restoring muscular power.

THE MECHANICAL TREATMENT OF INFANTILE PARALYSIS.

By JOHN RIDLON, M.D.,
CHICAGO.

The mechanical treatment of infantile paralysis may be directed to one of three ends, namely :

1. To the prevention of deformity.
2. To the correction of existing deformities resulting from the neglect of proper treatment ; and,
3. To remedial ends.

Both physicians and surgeons are too prone to take a hopeless view of these cases ; to neglect them during the interval which is between the onset of the disease and the development of the deformity ; to refer them to a surgical instrument maker for the application of conventional braces without a thought that these might be made a means of cure ; or to subject them to the never-ending blandishments of the sleek electrician.

Cases of infantile paralysis are in a certain way hopeless cases, in that they rarely fully recover ; but they are on that account the more deserving of an earnest and intelligent effort, and the gain, as a rule, fully repays the effort made.

The mechanical treatment of infantile paralysis should commence during the first stage—the acute attack—and should consist of any simple and convenient dressing which will put that part at rest and continuously retain it in the normal position until all sensitiveness of skin and muscles has passed away. Such treatment will often be rewarded by an early and complete restoration of function.

When the affected member is not retained in the normal position during the acute stage it assumes a position of more or less deformity—the affected muscles being stretched by their unapposed and

healthy antagonists; for some time this deformity can readily be overcome, but sooner or later this ceases to be possible, structural shortening having taken place in the healthy muscles.

The problem then is to rectify the deformity before attempting further treatment. This may be done by stretching or by a cutting operation. Theoretically a more perfect result should be had by stretching the structurally shortened muscles to their original length than by elongating their tendons by a cutting operation; but practically I have found the results equally good, and practically it is possible for only a few to successfully correct these deformities by stretching, whereas anyone may succeed with the knife. My personal preference is for the complete correction of the deformity by operative procedures before attempting mechanical treatment, and I believe it to be of great importance that the correction of the deformity be so complete that there is no tendency in the member itself to return to the old position. Then it will be found possible by simple means to retain the corrected position, and relapse can only arise from gross neglect. When the deformity has been fully corrected, and it is possible to readily maintain this new position, the limb is relatively in a like condition to that present before the development of the deformity, and treatment aimed to the cure of paralysis may be undertaken.

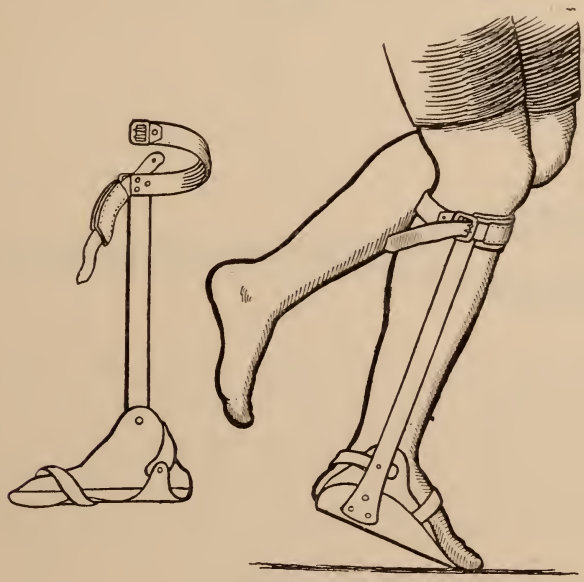
This treatment should consist in restoring the overstretched muscles to their normal length; in stimulating them to renewed contractility if any such remains in them, and, in case their usefulness is permanently lost, in inducing sufficient structural shortening in them to maintain the limb indefinitely in a useful position.

All that is necessary for the taking up of the slack in overstretched muscles is to place the limb in such position as will most completely relax the muscles in question and to uninterruptedly retain it in that position for a sufficiently prolonged period—that is to say, from six to eighteen months. Many muscles that at first appear to be wholly paralyzed regain much of their former contractility when given the advantage of diminished length.

The second stage of treatment—that of stimulating muscular contractility—demands the continuance of retentive appliances, but allows a certain range of use. For instance, in the usual paralytic condition below the knee, with dropping of the foot, during the

first stage of treatment I am accustomed to use Judson's brace without motion at the ankle-joint, but during the second stage to place a stop-joint between the foot-plate and the leg-piece, to prevent dropping of the foot, while at the same time it permits flexion of the dorsum of the foot toward the shin at the end of each step in walking. Stimulation of the part may be had by a variety of means. Baking

FIG. 1.



Judson's Brace.

of the limb in a special oven, either with or without rarification of the air in the oven, is of great advantage, but rarely can be carried on outside of an institution, and about all the overheating that the average case gets is to be had from an extra woolen stocking. Stimulation and exercise by electricity I believe to be useless, unless applied by the surgeon himself at short intervals covering a long period of time—two or three years. In the hands of the family it is practically useless, and in the hands of the quack an effective means of extortion. Almost the same good can be had by a simpler and an inexpensive method. Massage is a valuable remedy, but, like electricity, it is expensive and readily serves the purposes of quackery. Sometimes parents can be trained into using it with

gain, but more often it is by them neglected and done in a slipshod manner. A simple device, for which I am indebted to our late colleague, Mr. H. O. Thomas, which serves almost if not quite as useful an end as electricity, and at the same time takes the place of massage to an equal degree, is the daily flagellation of the part with a short whip, consisting of an iron handle ten or twelve inches long, to which is attached a double leather lash from an inch to an inch and a half in width. The rapid application of this instrument for a few minutes over the paralyzed muscles with the limb held in such a position as most completely relaxes the muscles will serve equally well for electricity or massage, and may be administered equally as well to the rich or to the poor.

Fig. 2.

Thomas's Whip.

In those cases where the paralysis of a muscle, or a group of muscles, is complete and recovery hopeless, much can be done by obtaining an exaggerated degree of structural shortening in the paralyzed muscles. The extremity should be placed in the extreme opposite deformity to that to which it tends, with the dorsum of the foot flexed into close opposition to the shin in drop-foot, and with the hands hyper-extended into drop-wrist, and in that position held continuously for a long period—at least for a year or eighteen months. Not once in all that time must it be allowed to drop. In this way sufficient structural shortening, as a rule, takes place to maintain the extremity in a useful position, and enables the patient to dispense with braces, a matter of no small moment, since otherwise the braces must be worn all through the period of the growth of the child, and not infrequently all through life.

The main point, then, which I wish to make in the successful treatment of these cases is the obtaining of structural shortening of the elongated muscles.

APOPLEXY OF INFANTS; PARALYSIS OF INFANTS.

By W. J. LITTLE, M.D.,
LONDON, ENGLAND.

When I responded to the invitation in the President's circular to contribute a paper to be read before the members of the Association and forwarded to him the above title, and consider, notwithstanding much opportunity of observation of symptoms, how little able I am to do the subject justice, I shrink from the duty I have undertaken.

Paralysis of the young had a special interest for me from an early period—that is, before I entered the medical profession. At the age of four years I suddenly became lame in the left foot. I was seen by several physicians and surgeons. I was considered to have had a *rick* in the ankle-joint. The only pathological idea in which the medical practitioners agreed was that the lameness was the result of an accidental injury.

Among the *theses defendendæ* of my inaugural dissertation, published at Berlin, 1837, that designated No. 3 reads as follows: "The result of section of tendons in talipes varus, talipes equinus, and in wry neck is not merely mechanical, but also dynamic." Thus, early in my study of distortions, I referred the primary cause of many distortions to the nerve-centres or to the peripheral nerves and muscles.

Since that distant period I have been desirous of ascertaining what are the changes in the nerve-centres on which the external accidents of infant and child-life depend, at least so far as sudden death or paralysis or constant contraction of parts depend.

During my student days at the London Hospital I performed the usual duties of a third year's student—that of attending a certain number of parturient women at their own homes.

Amongst these was one who, as well as her nurse, was in a state of violent intoxication from alcohol. I arrived in time to witness the birth of a dead child. The case suggested to me the inquiry whether the child died from poisoning by the alcohol circulating in the mother's system, or from the violence of the muscular struggles acting unduly through the uterus, causing suffocation and death to the infant by disturbance of its placental and cardiac circulation. There had been no mechanical difficulties with the labor.

Eight or ten years afterward, when I was practising as a consulting physician, I was requested to make a *post-mortem* in the case of an infant who was born dead two days before of an apparently healthy mother. I found copious apoplexy on the right side of the infant's brain in the middle of the corpus collosum.

I further ascertained from the husband the following incidents which preceded the birth of the infant: The parents had retired to rest at the usual hour; that soon after midnight the mother, who was in her second pregnancy, and was by no means a fanciful or nervous woman, and was almost a teetotaller, had hastily awoke her husband, and in an alarmed manner told him a mouse was running up the bed curtains. He kindly told her she had been dreaming—that she should go to sleep again. However, before another hour had elapsed the wife awoke him again, begged him to fetch the accoucheur and nurse, as she was sure that she was about to be confined. He complied with these requests. The accoucheur and nurse arrived in the nick of time, and assisted in the birth of a dead child.

Recently the daily papers contained the remarks of a London medical coroner lamenting the too frequent instances of infants a few days or weeks old being found dead in bed or in the mother's arms, "*overlaid*," as it is called; suffocated, it is supposed, beneath the bed-clothes, owing to some carelessness of the mother, or even to positive ill-doing on her part, such as her having gone to bed overcome by alcoholic beverages, so as to be incapable of taking due care of her infant. I may here remark that a case of overlaying, or supposed accidental suffocation, has occurred to my certain knowledge in a most respectably conducted family when the infant was already several weeks old.

The newspaper description of the evidence as to suffocation—"overlaying"—is very meagre; it contains no particulars as to the physical signs of suffocation beyond the fact that the infant was found dead, overlaid in the mother's arms or beneath the bed-clothes. No post-mortem examination of the interior of the infant's remains by a qualified medical witness has been previously made. I am far from wishing to impute blame or wilful misstatement on the part of the non-medical witness, nor do I doubt that sometimes actual suffocation of the infant has occurred.

But why should *neglect* on the part of the mother be assumed in these cases of "overlaying." The possibility of accidental suffocation beneath the bed-clothes cannot be denied; the mother's affection for the infant may, for example. tempt her to allow it to remain at the breast until she herself falls asleep, and the infant may struggle itself downward beneath the bed-clothes, and thus its life becomes extinguished. But this, if it occurs, is an accident for which the woman is to be sympathized with and pitied.

I believe that I have said sufficient to vindicate woman in general from the blame attributed through no unworthy motive by the medical coroner, and proceed to the consideration of what is due to society in general from our present standpoint of scientific knowledge.

If in the ordinary case of sudden death of an adult it is considered desirable to arrive at a precise knowledge of the cause of death by means of an examination of the internal organs, what reason can be assigned for the coroner and jury not requiring a post-mortem examination of the young child who has been found dead after some hours, days, or weeks of apparently healthful existence?

An independent gentleman when traveling has been found dead in his bed in an inn. The coroner orders a post-mortem examination. The cause of death is found to be "apoplexy," or it may be diseased heart. Is the life of an adult more sacred and precious to the State than that of a young child who has not only breathed in this world, but has exhibited some days or weeks of active breathing life and healthy functions? I venture to answer this question in the negative, and entertain no doubt that good to humanity, morality, jurisprudence, and medical science would

gain if the coroners and juries were encouraged not to determine on the cause of sudden death in cases in which unmistakable external causes of death are not apparent. I venture to say that many a woman who is wrongly supposed to have neglected her infant, found by a jury to have been "overlaid," could by the revelations of post-mortem internal examination be exonerated from suspicion and painful blame.

In the present day, both in America and England, lying-in institutions and hospitals for diseases of children abound which seem appropriate for the anatomical elucidation of this question. And as illustrative of the influence of mind upon matter, it may often be noticed that passing events of an untoward kind occurring during the gestation of the human female may leave their marks upon the progeny. It was my habit during the long series of years I passed in medical practice, on the occasion of a mother bringing her infant to me affected with some distortion, to inquire whether she connected the distortion of the child with any accident or untoward event which had happened during the pregnancy. I have frequently been informed that the mother had received during pregnancy a severe mental shock, such as an alarming accident to one of the children, the sudden death of parent, or the to her unexpected occurrence of her husband's bankruptcy, etc.

From the resulting lesion to the child it becomes evident to me that physical lesion of the brain or spinal cord of the infant in the parent's womb, and consequent distortion, could result fron intense mental disturbance of the mother and of her circulation. I know that a popular notion of this character pretty generally obtains. Considering the varieties of rank, education, and personal appearance and manners of the female parents, and the careful mode in which I conducted these inquiries, I have no doubt as to the facts and opinions I have narrated.

I believe that painful exciting causes disturbing the circulation of the mother may so affect the blood circulation in brain or spinal cord of the embryo as to excite disease there and consequent peripheral distortion. I have had the history of my own case, as it were, personally narrated to me by anxious consultants over and over again; the similarity of many narratives by the parents or friends of infants and grown-up children is so great as to leave no

doubt of their authenticity as far as the power of observation of the narrator is extended.

One practical deduction from the facts I have narrated is that we need more pathological knowledge of *the early stages* of disease, especially as many of the anatomical phenomena of adult age represent to us only the closing days of the disease.

I am also mindful that it is possible that infantile apoplexy and paralysis may sometimes result from accidental suffocation after birth—overlaying. Such a case can scarcely be confounded with apoplexy occurring before birth, if for a single day the newborn infant has been observed to actively move its lower limb.

THE TREATMENT OF ROTO-LATERAL CURVATURE OF THE SPINE BY NON-RESTRICTIVE AND DEVELOPMENTAL METHODS.

By B. E. McKENZIE, B.A., M.D.,
TORONTO.

It may safely be assumed that few would claim to-day that the treatment of spinal curvatures by means of braces or jackets has given results that are at all satisfactory. The last decade has witnessed a remarkable growth in the work of physical education, and surgeons have shown themselves very ready to adapt its principles to the correction of various deformities. As employed in the treatment of roto-lateral curvature it has accomplished, in a greater or less degree, three objects: enabled the patient who had a mobile spine to hold it more erect, re-educated the sense of erectness so that the attitude could be more easily appreciated, and caused general development and improved health.

That gymnastics alone have not given satisfactory results is evinced in the fact that very constant efforts have been made to invent some machine by which corrective lateral pressure might be applied with much force.[1] After its application restrictive measures have been employed generally to retain the degree of correction effected. In the experience of the writer the application of any form of brace, even for the purpose just stated, has not been satisfactory. It is not possible to so grasp the pelvis and spine as to be able to retain any great part of the correction effected by forcible pressure, and the degree of retention accomplished is at the expense of the natural supports of the body. It implies a neglect of the most important objects kept in view in the employment of gym-

[1] Bradford: Transactions Amer. Orth. Association, vol. iii. p. 128, and vol. iv. p. 354. Weigel: vol. ii. p. 265.

nastics; the patient is not being educated to hold himself erect, but is becoming habituated to a condition of dependence upon extraneous supports.

Omitting all reference to constitutional means, the treatment may be comprised under two heads: (1) to obtain such mobility of the spine as will permit of its nearest approach to normal erectness; (2) to educate and strengthen the power of the individual to maintain this approach to normal erectness.

Fig. 1.

A successful means of accomplishing the former object is illustrated in Fig. 1. The patient suspends himself at some distance from the floor by means of the usual strap-attachments under the

chin and occiput, from which the rope passes over a pulley to his own hands. While thus the weight of the body is employed to extend the spine, a lateral force is employed by passing a girth around the body at the place of greatest prominence of the curvature, having a rope attached which passes over another pulley and controlled by the surgeon. By this means, under the favorable condition of suspension and the consequent stretching of all the shortened structures in the concavity of the curve, very powerful corrective force may be employed. The girth is made to exert its traction in the oblique diameter of the thorax in such manner as to untwist the distorted spine, while at the same time it lessens the lateral curvature. The conditions, too, are the most favorable possible for allowing the surgeon to employ manual force for corrective purposes. The rope by which lateral traction is made may be fastened to a hook or given to an assistant. No force can be more effectively applied to lessen the complicated deformity which exists than the hands of the operator in moulding, pressing, and twisting the distorted thorax while thus all the shortened structures are so fully stretched.

After becoming accustomed to this treatment it may be employed several times a day, and it not only serves to accomplish the stretching referred to, but it is a means for giving effective massage to the deepest-lying structures involved in the deformity.

After the treatment just described the patients are then arranged in a class of not more than six or eight for practice in light gymnastics. There are advantages in taking them together in small classes. Work thus continued daily for months is liable to become irksome and monotonous; but the stimulus of association and the opportunity that each patient may have to see the improvement effected in another by some special work serve to keep up the interest and aid much to personal effort.

It is not necessary to specify here what particular exercises are most useful.[1] It is not so much the special exercises that are taken as it is the manner of their performance that is important. Each patient should, from time to time, be assisted and instructed, by the aid of a large mirror in which the attitude assumed may be seen,

[1] See article on "Roto-lateral Curvature," in Heath's Dict. of Surgery, by Bernard Roth. Gibney on "Roto-lateral Curvature," in Keating's Encyclopædia of Diseases of Children.

how to take the best position possible. During drill, and in the intervals, this is recognized as the ideal attitude for that particular case, and constant effort is to be put forth to maintain it or to return to it after each movement. The mirror is an effective aid in assisting an intelligent patient to appreciate an improved bearing. The surgeon must have sufficient resource to devise or select such exercises for each patient as will most assist in correcting the habits of asymmetry, and must so gain the confidence of his patient as to enlist her hearty co-operation.

FIG. 2.

Patients who are able, when assisted and instructed, to assume an attitude that approaches nearly to the normal may be treated without resorting to pressure correction.

In examination of patients with a view of determining the cause of the curvature, the pelvis should be carefully examined. Fig. 2 illustrates a case in which the extremities showed but little disparity when measured by ordinary methods, and yet the right iliac crest was one inch higher than the left, owing to lack of symmetry in the development of the pelvis. The left ilium was normally de-

veloped, while the right approached more nearly the vertical, as in the male pelvis. The consequent inclination of the plane of the base of the sacrum gave the sloping foundation on which the lumbar vertebræ began to build obliquely. One inch of cork did much to rectify the obliquity, and four months of treatment as outlined above gave a result that was most satisfactory.

For developmental treatment, as opposed to restrictive, it may fairly be claimed :

1. That by the use of any form of brace applied to the spine no near approach to complete correction of the deformity can be made ; and if made by other means, cannot be retained.

2. Such correction of deformity, or such retention of improvement as may be effected by braces is at the expense of the patient's independent action, by which alone she should maintain any improvement which may, by any means, be effected.

3. The utmost power may be employed to effect rectification without involving any restriction.

4. While all restrictive methods hamper the natural movements of the body, impede the functions of respiration, circulation and digestion, developmental methods directly increase the suppleness of the body, favor the vital functions, increase the tone and power of the muscles, produce increased thoracic development, and in general is a most effective means of improving the general health.

5. By constant drill the habit of erectness, or of an improved attitude, may be inculcated, and the spine be retained in as nearly a normal condition as it is capable of assuming.

APPARATUS FOR THE CORRECTION OF SCOLIOSIS.

By M. SCHEDE, M.D.,
HAMBURG.

In 1891 an apparatus was shown before the German Society of Natural Philosophy, at Halle, for the reduction of the most severe scoliotic curvatures of the thorax in young children. This apparatus has, since then, been vastly improved, and, in accordance with the ideas of the originator, has been strengthened, and been made to exert a greater influence upon the deformed bony framework of the thorax than any other known apparatus.

It consists primarily of an iron gallows-like frame, in which the patients are suspended by the Sayre method. The tips of the toes touch the ground, and the hands high, outstretched, grasp two handles. The pelvis is placed between two compress-pads which fix it immovably from before backward. Another such arrangement fixes the shoulder girdle, so that the rotating power of the thorax can work only by twisting the vertebral column and bending the ribs, not, however, in the sense of a rotation of the upper half of the body, upon the lower, or *vice versa.*

The thorax, thus fixed in the most tense position, is surrounded, at a distance of about 15 centimetres (6 inches) by a strong iron ring, which holds the necessary supporting apparatus and interposes the working of the forces, which will tend to remove the deformity. These forces are: 1, detorsioning traction; and, 2, pressure by compress-pads.

As it happens, the treatment of scoliosis has not kept pace with our knowledge of its pathology. We have long known of the torsion of the vertebræ, but we have done little to combat it.

All of the numerous existing forms of apparatus for the relief of scoliosis operate almost entirely through long-continued pressure,

and yet, even where a detorsioning action was aimed at, as a result of defective technique, the desired result was not obtained. As the detorsioning force, ordinary traction weights, which are fastened to the thorax by means of strips of adhesive plaster, are used.

In the case of an ordinary convex scoliosis with the usual rib tuberosities, strips of adhesive plaster, 15–25 centimetres (6–10 inches) wide, split at one end, would be fastened to the skin of the patient (after the fatty matters had been removed with ether), so that the hinder division would run forward from the right side of the vertebral column over the posterior tuberosities of the rib, the other backward on the left side from the middle of the sternum over the anterior tuberosities of the ribs. The free end of the strip is folded and sewed to a small ring, in which a hook with the cord and weight may be fastened. The latter run over pulleys which are attached to the aforementioned ring. The pulleys are raised to such a height that the cord runs out horizontally, and they are so adjusted as to enable a powerful rotating force to act. This action of the traction weights is strongly and judiciously aided by compress pads, which likewise, by means of long screw worms, may operate from the same ring, with whatever strength desired, upon the rib tuberosities. The direction of the pressure will always be, primarily, against the prominent part of the rib tuberosities, not against the temporary projection of the vertebral column, since, in at least the severest cases, such a procedure would only increase the bending of the ribs. Under the combined action of traction and pressure in the apparatus, the deformity disappears, the too greatly convex parts become more flattened, and the flattened parts become more strongly convex. This stronger forward arching even goes beyond the desired degree, since the cartilaginous part of the ribs yields too readily, and here an artificial anterior rib tuberosity arises. This is prevented by a supporting pad, and, by this means, the arching of the ribs is not increased forward, but sideways, and also at the points where it is to be increased. In complicated cases, where there is a pronounced S-forming scoliosis, the application of the detorsioning force and the pressure must be correspondingly regulated. Two traction-weights are often employed, one for the upper division of the thorax, the other for the lower, passing in opposite directions. The heaviness of the weights must be deter-

mined by the extent of the deformity and the strength of the bones, It begins usually with 2–3 kilogrammes ($4\frac{1}{2}$–$6\frac{1}{2}$ pounds) for each weight, and ascends under circumstances to 6–8 kilogrammes (13–$17\frac{1}{2}$ pounds).

The patients should be placed in the apparatus twice a day, for half an hour each time, and should receive as much as they can bear with comfort. The operation is, as the steady removal of the deformity demands, naturally a slow one with this apparatus also, even though it has often helped at the first trial, in cases where the thorax was not too stiff; in these cases, while the aforementioned forces were in operation, the deformity was seen not only to become less but even to be changed.

We can often force, in three months, a measurable and appreciable improvement, even in the most obstinate cases. Naturally, this course must be supplemented by periodical measurements, development of the muscles, etc., but especially by a good spinal support. For about a year I have been applying Sayre's plaster-of-Paris jacket in this treatment. For this purpose the ring is opened at its junction, and thrown back; after the application, it is again closed. The pelvis and the shoulder girdle are now rapidly fixed, and the compress-pads allowed to act upon the still soft plaster-of-Paris, and to let it harden in the strongest possible corrected position. The strong correcting pressure acts as a good support, the jacket fits much better than those applied in the ordinary way, and its orthopedic working is often surprising.

NOTE.—Dr. Schede emphasizes the fact that the plaster-of-Paris jackets as applied with this apparatus and fashioned by the pressure-pads while they are hardening are of considerably greater efficiency than when applied by simple suspension. They fit much better, the unpleasant sticking of the edges is very much lessened, and their powerful action is furthermore shown by the fact that the patients when in the jackets are from 2–5 centimetres taller than without them. The heaviness of the weights has been by degrees considerably increased. To each of the four adhesive strips is attached, in the severest cases, a weight of $7\frac{1}{2}$ kilogrammes ($16\frac{1}{2}$ pounds), making altogether a traction of 30 kilogrammes (66 pounds). This does not include the force of the pressure-pads.

FIXATION IN THE TREATMENT OF FRACTURES INTO JOINTS.

By ANSEL G. COOK, M.D.,
HARTFORD, CONN.

All text-books on surgery that I have been able to consult actively assert or tacitly admit that fixation of an injured joint produces ankylosis. This statement is entirely arbitrary. No explanation is given how fixation causes ankylosis, nor the amount of time required to produce this condition. The same books also teach that broken bones should be set and kept in place till firm bony union has resulted, and explain clearly the physiological processes through which union is brought about. The question of passive motion is therefore a most difficult one to decide. If the surgeon moves the joint he disarranges the fragments of broken bone and hinders union; if he fails to make passive motion the joint becomes ankylosed.

Hamilton, more afraid of ankylosis than non-union, says that in fractures into the elbow joint passive motion should be "inflicted on the joint as early as the seventh day after the injury," while Bryant (English), though admitting fixation as a cause of ankylosis, thinks passive motion should be delayed till the end of the third or fourth week.

The subject is also of medico-legal interest; unserviceable limbs, the result of fractures, are the cause of the majority of law-suits for malpractice, and it is important that the general practitioner should thoroughly understand the few simple principles that govern the intelligent treatment of fractures and kindred injuries, even though he has not the skill to put them into practice. With the present accurate knowledge of the injuries to the bones, ligaments, tendons, fasciæ, muscles, synovial membranes, bloodvessels, and nerves, and

knowing, also, the degenerative and inflammatory processes that may follow such an injury and the physiological processes by which these different structures may be completely restored, it seems illogical that early passive motion should be advised as a preventive for ultimate ankylosis of the joint.

Broken bones not involving joints are treated by placing the fragments in apposition and keeping them at rest till union is complete. Cut tendons and muscles are sutured, confined by plasters, or simply approximated, as the case may be, and kept at rest till they have united. Ruptured arteries are tied or twisted when the hemorrhage does not stop spontaneously, and when of large size the parts to which they supply blood are kept at rest till collateral circulation is established. Ligaments do not differ essentially in structure from tendons, nor synovial membranes from tendon sheaths; yet when all these various structures are grouped together in the formation of a joint, and the joint injured, a line of treatment is advocated that is universally acknowledged to be incorrect if applied to each of the component parts when considered separately.

It is also universally admitted that ankylosis, either bony or fibrous, is the result of cell proliferation during inflammation, or during the reparative process following inflammation; yet passive motion, which necessarily irritates the injured structures and increases inflammation is declared to prevent ankylosis.

When this subject was discussed at the meetings of our city and county societies it was stated, and I find very generally believed in Connecticut, that in a fracture into a joint callus was thrown out into the joint, and that if this was left to itself a nodule of bone would form that would seriously restrict motion; whereas, if early passive motions were made carefully, the plastic callus would be rounded off or smoothed, just as by imperfect fixation of a fracture in the shaft of a long bone a false joint is formed, and that these motions, sufficient to smooth the callus, could be made carefully without disarranging the fragments of bone or exciting inflammation.

This exceedingly ingenious theory of smoothing down hypothetical deposits of plastic callus in unknown situations by early passive motions so delicately made as not to disturb small and easily moved fragments of bone, and to rub the raw surfaces of

ruptured ligaments together so gently as not to retard the healing, I believe to be impossible. Callus is not putty or plaster-of-Paris, but a simple exudation of lymph which afterward thickens and solidifies. If this lymph were poured out into the cavity of a joint, it would mix with the synovial fluid, which it closely resembles, and could not solidify unless the whole contents of the joint ossified. Furthermore, bone is never deposited on smooth cartilaginous surfaces, and the exudated callus, if it could ossify, would be a loose body.

I am aware that false joints covered with imperfect cartilage and lubricated by a kind of synovial fluid occasionally exist, the result of fracture. The *American Text-book of Surgery*, published in 1892, p. 290, gives imperfect immobilization as one of the causes that produce this condition. These true false joints, as they are sometimes called, to distinguish them from ligamentous union, are exceedingly rare, and the records of such cares are too incomplete to allow a thorough study of their pathology.

It is evident, however, that there must be some primary cause for the non-union, and that motion is only a secondary factor in the formation of the new joint. Certainly these joints cannot be made to order by any system of active or passive movements.

I quote once more from the *American Text-book of Surgery*, p. 282: "If there is much permanent displacement, or if the fragments are not effectually immobilized during repair, the callus will be larger than under other circumstances, and the tendons and fibrous tissue attached to the bone near the fracture may be included in the area of irritation and become ossified. Such ossification at a distance, may be destructive to the functions of the limb, as when a fracture is in the neighborhood of a joint, or in the case of the radius and ulna, which may become united to each other with consequent loss of rotation of the forearm. Sometimes a neighboring joint becomes entirely obliterated by bony union of its opposing articular surfaces." To correctly estimate the physiological effects of immobilization, we have only to impartially examine joints that have been immobilized. The material is abundant. Nature immobilizes joints by muscular action in diseases of the bone months before true ankylosis takes place. Orthopedic surgeons immobilize diseased joints for months or years, and are com-

pelled to immobilize healthy joints as well, when the perfect immobilization of the former depends on the fixation of the latter, as in Pott's disease, treated by Sayre's plaster-jackets or the fixation of the knee when the long traction splint is applied for hip disease. Many injuries compel immobilization of normal or injured joints for a longer or shorter period—the ankle in fractures of the bones of the leg, the knee in fractures of the patella, or the shoulder and elbow in fractures of the clavicle. It is well known that Indian fakirs immobilize their limbs, etc.

RESULTS.—No normal joint has ever been proved to be ankylosed or even inflamed by inflammation *per se*. If the immobilization has been performed in such a manner as to produce inter-articular pressure of the bones, or the bandage so tightly applied as to interfere with the circulation and produce sloughing or gangrene, the case cannot be considered one of simple fixation. Fixation, though it does not cause ankylosis or inflammation, produces important changes in the tissues—muscles atrophy from disuse, bones become more porous and friable, bloodvessels diminish in size and number, and in the young the development of the limb is retarded. It seems probable that immobilization would diminish temporarily the supply of synovial fluid, and render the membranes and tendons less pliable; I am inclined to this opinion, though Phelps, in examining dogs killed nearly five months after their joints had been carefully immobilized, found the synovial fluid undiminished in quantity, and the tendons, ligaments and membranes in all respects normal. A certain amount of motion is necessary for the growth and development of all the tissues of a healthy joint; when the joint is immobilized the tissues atrophy, and growth is retarded. When the joint is again used, no matter how long the period of immobilization may have been, the tissues regain ther normal consistency. When the patient is young, and the period of immobilization has extended over months or years, the matter of retarded development may become a serious detriment to the future use of the limb. Massage is useful in restoring atrophied but otherwise healthy muscles to their former usefulness, in breaking up minor adhesions, and in removing the products of inflammation by increasing the blood supply, and thus hastening absorption.

CONCLUSIONS AND RULES OF TREATMENT.—1. That bony or serious fibrous ankylosis is the result of injury and subsequent inflammation and not of immobilization.

2. That early passive motion only disarranges the fragments of bone, thereby increasing the production of callus, that it irritates the injured ligaments, and by increasing the inflammation tends to produce the ankylosis it is thought to prevent.

3. Immobilization is useful *only* when active inflammation is present, or until the ruptured ligaments and broken bones have thoroughly united.

4. The logical treatment of a fracture into a joint, therefore, should be rest and local applications to reduce inflammation; reduction of the fracture as early as possible, then immobilization until the bones and ligaments have united (from three to eight weeks, or more, according to circumstances).

5. Passive motion, massage, and use until the tissues become normal, or if massage fails, complete rupture of all adhesions under an anæsthetic. The factors which will ultimately determine ankylosis are the nature of the original injury, the character and duration of the subsequent inflammation, the destruction of bone and cartilage, cicatricial contraction of the soft tissues around the joint, and the age and condition[1] of the patient.

DISCUSSION.

DR. COOK first asked if any member believed that fixation of a healthy joint *per se* produced ankylosis of the joint.

DR. SHAFFER replied that the surgical world was of the opinion that a perfectly healthy joint was not liable to become ankylosed. He could recall a case where prolonged traction at the hip had produced synovial trouble, but ordinarily ankylosis was not to be expected.

[1] Phelps and others believe that the nervous system plays a part, not yet understood by us, in determining the matter of ankylosis, particularly in those cases where a part of all the joints of the body become ankylosed without local or manifest cause, and my own observations have led me to accept this theory.

Dr. Weigel said it was not always desirable to obtain motion in a joint in a case of fracture into the joint. He recalled a case in which a young lady was suffering from in-knee because of the occurrence of motion.

Dr. Ryan said that a single instance of that sort should not disturb us, for it was a general law in surgery that an ankylosed joint was not to be sought for. The use of persistent passive motion at an early stage in the treatment of fractures in and about joints was a very good and very useful one. Some years ago, when he was interne in the Hospital for the Ruptured and Crippled, he had become interested in cases of ankylosis of the elbow, and had made notes of a number of them. From this study he had concluded that, following fracture, these joints in time became very useful, and that in most instances there was perfect flexion, although not quite perfect tension. In his own practice he was in the habit of beginning passive motion at about the sixteenth day after a fracture of the elbow, and this was kept up daily. He thought the result was far better than if passive motion were longer postponed.

Dr. Brackett said he had noticed that children had come to him from other hospitals where passive motion had been practised, complaining greatly of pain. In these children the motion was often decreasing. By placing them in splints for a number of weeks the motion had been increased. Most of his cases had resulted in nearly perfect motion.

Dr. R. F. Weir, of New York City, being invited to take part in the discussion, said that the paper expressed the views which he thought most surgeons now entertained regarding the immobilization of joints. They did not believe in early passive motion.

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